

ANNALS of SURGERY

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No. 2

PLASTIC SURGERY OF THE FACE

By EMMETT DE WITT HIGHSMITH, M.D.

OF ATLANTA, GEORGIA

PLASTIC surgery is concerned with any portion of the body in which there are defects from any cause, or from errors of development, though only deformities of the face will be discussed in this paper.

The chief aim of this work is to restore function, as well as to correct deformities. The technic differs to some extent from general surgery, especially operations on the face. As it is very necessary to prevent scar tissue as much as possible, we must be careful not to traumatize delicate tissue, lest our carelessness be registered in a deforming cicatrix.

Possibly the most frequent facial deformity we are called on to correct is harelip and cleft-palate, and while this condition is not a menace to life, these unfortunate individuals are greatly incapacitated, and as this deformity is relatively rare, too often they are allowed to go through life without correction or encouragement. The general surgeon only sees a few cases in a lifetime, though I think there is a greater number than is generally supposed.

Davis claims that harelip occurs once in 2400 infants; that there are 73 per cent. more males than females; and that more often a left side involvement than right.

Harelip operations should be done early. If there is a separation of the gums it is of the utmost importance that these cases be operated on before the fourth month, in order that the alveolar process may be bent and held in apposition by metal splits.

Lip operations can be done well at any age. In order to overcome the stiffening effect of the scar, whether the patient be infant or adult, it is essential to exercise the lip through massage, and in the case of an infant the use of the pacifier is beneficial for this purpose.

The cleft-palate cases should be done before the child learns to talk, as it is very hard to break them of their nasal sounds, once they have been established.

Rhinoplastic operations are even more rare than lip operations, though often the deformity is much more unsightly. While these patients do not suffer real pain, their humiliation is great and many are robbed of the chance to earn a livelihood by their unsightly appearance. The great value of these operations is the cosmetic and psychic effect.

In the reconstruction of a nose there are three essential factors to be considered:

- 1st. An epithelial lining.
- 2nd. A bone or cartilage framework.
- 3rd. A skin covering.

The epithelial lining can be obtained from the adjacent skin with a pedicle.



FIG. 1.—Case I. Front view showing destruction of nose and lip; before operation.



FIG. 2.—Case I. Profile.

If bone is to be used for the bridge it can be taken from the outer table of the frontal bone of the forehead attached to the flap to be used for the skin covering.



FIG. 3.—Case I. Showing patient ten days after first operation with Wolf graft in place on forehead, and before pedicle of nose is cut and returned.



FIG. 4.—Case I. Showing patient six months after the nose and lip operation has been completed.

I prefer cartilage to bone, which can be easily obtained from the ninth costal cartilage. In this case it is best to cut the cartilage to the size and shape desired, leaving on all the perichondrium possible, embed this in centre of the flap to be used from the forehead ten days prior to the operation in

PLASTIC SURGERY OF THE FACE

order that the circulation may be thoroughly established before the flap is disturbed.

CASE I (Fig. 1).—A young woman age thirty-one. Had always enjoyed good health until eighteen years of age, when a hard, indurated ulcer appeared on the upper lip which remained for six months with very little change. After that time it began to spread very rapidly, destroying the upper lip and nose to the



FIG. 5.—Case II. A young man twenty-four years old with a congenital deformity of the nose and lip. Family and past history negative.



FIG. 6.—Case II. Three months after operation.

nasal bones. Up to this time no diagnosis had been made; a later consultant was supposed to have given her some "blood medicine" and the ulceration rapidly healed. She came to the Gray Clinic in Atlanta in 1920, examination



FIG. 7.—Case III. Shows baby three months old with unilateral harelip with wide cleft through alveolar process extending through horizontal process of palate with deviation of nasal septum to the right.



FIG. 8.—Case III. Eight weeks after first operation and two weeks after second operation.

showed a 4-plus Wassermann. She had taken thirty-two doses of Diarsenol with a 3-plus Wassermann when the first operation on her nose was done. Three months after the operation was completed she had a 4-plus Wassermann.

Technic of Operation.—Ten days prior to the nose operation the rudimentary

EMMETT DE WITT HIGHSMITH

septum was cut above, leaving a pedicle below, and brought down to act as a part of the supporting framework and the septum of the new nose. Also a piece of cartilage about one and a quarter inches long was taken from the ninth costal cartilage and cut to the size and shape desired, and slipped under the skin of the forehead in the centre of the flap to be used for the skin covering of the nose. At the time of the nose operation the patient was given 4-½ ounces of ether in olive oil, colonic method, which completely anæsthetized her for a period of two hours. A cross incision was made through the skin on the nose and equal distance above to the prepared septum below, and turned down, leaving epithelial side down for the skin lining, and sutured to the prepared septum. A triangular piece of skin on each side of the nose was turned up and sutured to the first flap and septum, completing the epithelial lining. Then by actual measurement with a piece of tin foil, the skin covering for the nose was cut from the forehead with pedicle attached, leaving the prepared cartilage in the centre, sutured and dressed with Carpenter's court plaster.

CASE II (Fig. 5).—A young man, twenty-four years old, with a congenital deformity of the nose and lip. Family and past history negative.

Technic of Operation.—A horizontal incision through upper lip just above vermilion border and closed with dermal suture, bringing the thin tab down which gives the appearance of the cupid's bow, and dressed with Carpenter's court plaster which was left on five days.

In correcting the nose, a vertical incision was made commencing in the centre over nasal bones and extending to near the tip of nose. A portion of nasal bones was chiseled off, the cartilage on right was removed and the cartilage on left swung to the centre for the supporting framework of the nose. The redundant skin was cut away, and dressed with Carpenter's court plaster.

HARELIP AND CLEFT-PALATE DEFORMITIES, SOME OF THE TYPES AND THEIR OPERATIVE TREATMENT*

By WARREN B. DAVIS, M.D.

OF PHILADELPHIA, PA.

THROUGH the kindly interest of my chief (Dr. J. Chalmers DaCosta) in my work in maxillo-facial surgery, it has been my good fortune to have the privilege of operating upon all harelip and cleft-palate cases admitted to "Surgical Division A" at the Jefferson Hospital since 1915. Our endeavor has been to make the most of this opportunity by familiarizing ourselves with the numerous operations which have been devised for the correction of the varying degrees of these congenital defects, selecting such operative measures as seemed most practical and applying them to those cases which seemed best suited to a particular type of operation. Thus we have no "new operation" to describe, but we have assembled a composite technic which is giving gratifying results in a large majority of cases—both from the functional and the cosmetic viewpoints.

We will illustrate by individual cases a few of the types of deformity, describe briefly the essential points in the methods we have found most efficacious in dealing with each type, showing photographic records of the results obtained.

Unilateral Harelip.—Single, simple harelip deformities (Figs. 1 † and 5), complete or incomplete, usually require the same general plan of treatment, since in the majority of cases in which the cleft extends as far as half-way through the lip, there is little or no muscle tissue between the upper angle of the cleft and the floor of the nostril. To correct this condition it is necessary to convert such incomplete clefts into complete ones in order to secure approximation of the muscles and to properly correct the flattening of the ala nasi and the accompanying widening of the nostril.

In outlining incisions for the correction of harelip, the method devised by J. E. Thompson has, in our cases, been by far the most satisfactory—both at the time of operation and in the end results. With sharp-pointed calipers the distance is measured from the mid-point of the floor of the nostril to approximately the point in the same sagittal plane to which the free margin of the lip would come if it were of normal contour. Fixing the distance on the calipers and keeping the superior point at the mid-point of the floor of the nostril, the inferior point of calipers is rotated, describing an arc which crosses the vermilion border of the lip on each side of the cleft (Fig. 2). The points where the vermilion borders are crossed by the arc are distinctly

* Read before the Philadelphia Academy of Surgery, February 6, 1922.

† Figures 1-4, 7-10 and 12 are from the author's article in the *Surgical Clinics of North America*, February, 1922, and are used here by the courtesy of the W. B. Saunders Co.

marked by making a puncture with the point of the calipers or with a small scalpel. Points on the free margin of the lip are then located so that lines connecting the three points on each side of the cleft (the mid-point of the floor of the nostril, the point marked at vermillion border, and the point now being located on free margin) will form an angle of approximately seventy



FIG. 1.—Case I. J.M. Age twelve months. Unilateral harelip. Note moderate flattening of the ala nasi and consequent widening of nostril.

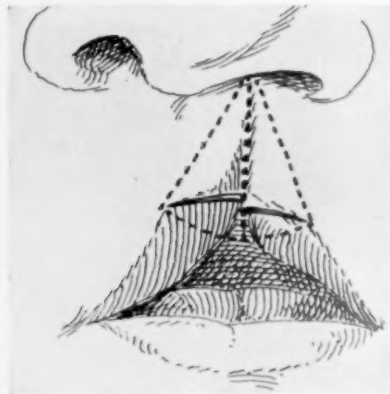


FIG. 2.—Semi-diagrammatic sketch, showing application of Thompson method of determining points for lines of incision for correction of harelip, as used in Case I. (See description in text.)

to eighty degrees—the angle being equal on the two sides. Incisions carried through the entire thickness of the lip with a narrow scalpel at a right angle to the skin surface and following along the lines as outlined, will give



FIG. 3.—Case I, four hours after operation. Note position of sutures, and the fulness at point of approximation on free margin of lip.



FIG. 4.—Case I, showing contour of lip and nostril, six and one-half months after operation.

surfaces for approximation which are of equal length and which when sutured together will give a lip the length of which is the estimated normal length plus the distance from the vermillion border to the free edge, which is usually just sufficient to allow for subsequent contraction. Before approximating the margins it is essential to free the supero-lateral portions of the lip from the

HARELIP AND CLEFT-PALATE DEFORMITIES

anterior surfaces of the maxillæ through incisions made above the alveolar process. This relieves tension and allows the ala nasi to be brought into approximately normal contour. Figure 3 shows Case I four hours after operation. Figure 4, six and one-half months later.



FIG. 5.—Case II. H. S. Age five months. A less extensive unilateral harelip, showing scantiness of muscle tissue in upper portion of lip between the angle of the cleft and the floor of the nostril, with the consequent flattening of the ala nasi.



FIG. 6.—Case II, showing contour of the lip and the improved position of the ala nasi, eleven weeks after operation.

Case II shows a much less extensive harelip (Fig. 5), yet the nostril is distinctly flattened and widened. By carrying the incisions into the floor of the nostril, securing muscle approximation and bringing the ala of the



FIG. 7.—Case III. H. E. F. Age five months. Complete unilateral harelip and cleft palate.



FIG. 8.—Sketched from an operation on a child three months old, showing partial division of alveolar process, posterior to canine area on right side, to facilitate bringing the premaxilla into normal position, closing the cleft in the alveolar process on left side. A silver wire suture holds the parts in apposition.

nostril into proper position, a normally functioning lip and a greatly improved nostril were obtained with but slight increase in the linear scar (Fig. 6).

Complete Single Harelip and Cleft-Palate (Fig. 7).—This type shows wider separation of the lip margins, marked flattening of the ala nasi, deflection of the nasal septum to the opposite side and varying degrees of antero-superior rotation of the margin of the premaxilla. The surgical treatment is preferably by a two-stage operation—both operations being completed before the child is two years old. We believe best results are obtained by closing the cleft in the alveolar process and repairing the harelip at the first operation, which should be done as soon as the child is in good condition, and it is known that the formula used in feeding is a suitable one. We usually select a time somewhere between the tenth day and the third month. The repair of the remaining cleft of the palate is preferably done sometime



FIG. 9.—Case III. Twenty-two months after first operation, showing union in alveolar process and the position of teeth.



FIG. 10.—Case III. January 15, 1922, twenty-five months after first operation, showing contour of lips and nostril.

between the twelfth and twentieth months. By such a schedule the deformity is less and the articulate speech better than in cases operated upon at later periods.

A wide alveolar cleft is repaired by partially dividing, with a thin chisel, the buccal side of the alveolar process just posterior to the canine region, on the side opposite the cleft, and then by combined digital pressure on the antero-superior portion of the premaxilla, and intra-nasal pressure against the lower portion of the nasal septum and the nasal floor with a small Sinexon nasal dilator, the alveolar margins are forced together. (Narrow clefts may sometimes be approximated in infants without the preliminary partial division of the alveolus.) The margins of the cleft must have the mucous membrane removed so that raw surfaces can be brought into contact. A green-stick fracture occurs at the point of partial division of the alveolar process, the degree of fracture depending upon the width of the cleft to be closed. The margins are held in approximation by a silver wire applied as shown in Fig. 8.

This procedure not only closes the alveolar cleft, but by bringing the premaxilla to its normal position, the deviation of the nasal septum is corrected

HARELIP AND CLEFT-PALATE DEFORMITIES

and the width of the cleft in the lip greatly decreased. The lip is then repaired in essentially the same manner as described above, but requires greater separation of the lip from the anterior portion of the maxillæ, and greater care in bringing the base of the ala nasi sufficiently medial by the first suture applied at the floor of the nostril. Figure 9 shows Case III, twenty-two months after operation. There is complete union of the alveolar process and the prospects are that but little orthodontic work will be required later, presuming that the permanent teeth will be in as good position as the deciduous.

The closure of the remaining cleft in the palate we prefer to do by the Langenbeck muco-periosteal flap-sliding method. If the width of the cleft



FIG. 11.—Case IV. E. McG. Age four weeks. Double harelip and cleft palate, incomplete on left side.

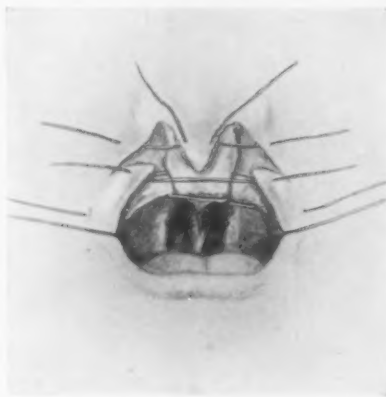


FIG. 12.—Sketch from an operation on a three months old child with double harelip and cleft palate, showing premaxilla held in position by silver wire suture through alveolar processes, and the incisions made for repair of lip defects. (The sutures shown through the entire thickness of the infero-lateral portions of lip are temporary traction sutures which assist greatly in handling the lip, producing less trauma than does the use of forceps.)

is sufficient to make additional width of flap necessary, the muco-periosteal flap dissection can be carried around the lower margin of the vomer on the attached side and one-fifth to one-fourth inch of mucosa taken from the lower portion of the nasal septum. These procedures were used in Case III, in which the second operation was at twenty-seven months of age. The separation of the muco-periosteal palate flaps from the nasal mucosa at the posterior margin of the palate bones is important to secure sufficient relaxation at that point. Moorehead, *Journal A.M.A.*, December 17, 1921, regards this step as the most common cause of non-union, but it has not proven so in our cases. We prefer to approximate the margins of the flaps with interrupted sutures of 00 wire, from the anterior point of cleft to the junction of hard and soft palate, at which point one on-end silk mattress suture is used. Posterior to this point interrupted black silk sutures are used. Small iodoform gauze packs in the lateral incisions aid in relieving tension.

Packs are removed in forty-eight hours. If the horizontal process of the maxillæ and the palate bones are not sufficiently developed to hold such a pack safely, then an iodoform gauze tape is passed around both flaps (Mayo method) and tied or sutured at proper tension—using care that circulation in the flaps is not restricted.

Post-operative treatment: In infants, water only is given by mouth during first six or eight hours, then gradually resume formula used previous to operation. In older children, an abundance of water only is given by mouth during the first twenty-four hours. Salt solution containing soda bicarbonate is given by bowel at three-hour intervals during the first twenty-four hours. Small doses of deodorized tincture of opium are given if needed to allay



FIG. 13.—Case IV, nine days after operation, shortly after sutures were removed.



FIG. 14.—Case IV, two months after operation. Note contour of nostrils.

excessive crying. A few drops of fifteen per cent. argyrol solution are placed in the nasal passages with a dropper every three hours. No intra-oral applications are made routinely in infants.

In older children and in adults, a normal salt solution mouth wash is used at three-hour intervals, followed by argyrol application along suture line and in lateral incisions. In these older cases, liquid nourishment is continued for eight days, then semi-solid diet is allowed. Solid food is not given for sixteen days. Figure 10 shows Case III, January 15, 1922, twenty-five months after first operation. The articulate speech is good and shows the advantage of complete early closure of clefts.

Bilateral Harelip and Cleft-Palate.—Case IV illustrates bilateral harelip with wide separation of margins, and double cleft palate, complete on right side, but not extending through alveolar process on left side (Fig. 11).

When the child was four weeks old, the cleft in the alveolar process was repaired as described in Case III. Measurements for lip margins were by the Thompson method. The philtrum was trimmed to a "V" shape just within the vermilion borders. Incisions were similar to those shown in Fig. 12. The wide separations of the margins necessitated more extensive

HARELIP AND CLEFT-PALATE DEFORMITIES

freeing of the lip from the anterior surfaces of the maxillæ to allow approximation without undue tension, and to bring the alæ of nostrils into approximately normal position. To avoid tension on suture lines, a stay-suture of silkworm gut was passed far lateral on each side, and held at desired



FIG. 15.—Case V. L. P. Age seventeen years. Opening in hard palate persisting after an operation for double cleft palate, which was done when patient was one year old.



FIG. 16.—Case V, showing good union of soft palate and the opening in hard palate.

tension by perforated shot over a button resting on adhesive plaster (one-half inch by three-quarter inch) to give increased surface traction and prevent much cutting of skin by the suture (G. V. I. Brown method). Figure 13

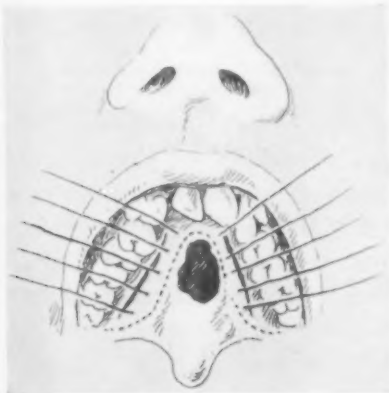


FIG. 17.—Semi-diagrammatic sketch of Case V. Dotted line indicates margins of bony cleft. Lateral incisions are shown, through which the bones were divided.



FIG. 18.—Semi-diagrammatic sketch of Case V. showing approximation of the margins of the opening in the hard palate. The site of the green-stick fracture produced anteriorly is indicated, as are also the posterior ends of the bones in their new position.

shows condition of Case IV, nine days after operation, shortly after the sutures were removed. Figure 14 is Case IV two months after operation. We have advised closure of the remaining cleft in the palate when the child is twelve months old. So wide a cleft may necessitate a two-stage operation,

the first loosening the muco-periosteal flaps through Langenbeck incisions, making the separation to, but not through, the medial margins, then making partial approximation by packs for several days, after which the margins of the cleft will be removed and definite approximation of flap edges made.

Incomplete Union in Hard Palate.—Repair of a defect in the hard palate which had persisted after an operation in early childhood for double cleft palate. Often a secondary repair is more difficult than a primary operation, because of scar tissue, poorer circulation and less tissue for flap formation. Such openings in the hard palate are tedious to close, especially if located far anterior. Case V shows an opening in the hard palate of a girl seventeen years old (Figs. 15 and 16). The primary operation was done by another surgeon when the patient was one year old.



FIG. 19.—Case V. Photograph of palate two months after operation.



FIG. 20.—Case V. Photograph of posterior portion of palate, two months after operation.

We believed that such an opening could be closed by any one of three methods. (1) By making lateral incisions, just within the alveolar process on each side, loosening muco-periosteal flaps and approximating them in midline, as in the Langenbeck operation. (2) By turning a muco-periosteal flap from the right side (the side in this case having the best blood supply), keeping its attachment at the margin of the opening, and carrying the turned loosened flap beneath a double-pedicled flap on the opposite side, suturing it in position, after the Lane method. (3) By bringing part of the horizontal processes of the maxillæ and palate bones medially with the attached soft tissues.

We have usually employed the first method in closing such openings, except when the opening is just posterior to the premaxilla, in which case the second method is preferable—unless the opening be a very small and narrow one. In the case illustrated here, however, the extent and position of the horizontal processes of the maxillæ and palate bones were such that we elected to try the third method, following essentially the plan devised by Ferguson, advocated

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for many years by J. Ewing Mears, and later revived, improved and so successfully used by W. J. Roe in his primary cleft palate operations.

The mucous membrane was removed from the margins of the opening, carrying the incisions a short distance both anterior and posterior beyond the margins of the opening, in order to make its outline elliptical. Lateral incisions were made as shown in Fig. 17, and the muco-periosteum separated from the underlying bone for a distance of about one-eighth inch along the lines of incision. The horizontal processes of the maxillæ and palate bones were then cut through along these lines with a thin chisel and the overlying nasal mucosa also divided. The lateral incisions were extended posteriorly to the anterior portion of the soft palate. The strips of bone and the attached soft tissues were then forced medially, producing a green-stick fracture at



FIG. 21.—Case VI, C. B. Age 20. Showing deformity persisting after an operation for bilateral harelip, when patient was eight months old.



FIG. 22.—Case VI, showing contour of lip after secondary repair.

the anterior attachments of the bones, when the medial margins were approximated. Small holes were made in the partially detached bones and the soft tissue covering them, through which interrupted 00 wire sutures were passed and tightened sufficiently to hold the medial margins in apposition (Fig. 18). One advantage of this method for this case was that the palate was slightly lengthened—a point of much value, especially in an adult case.

The lateral openings were packed with iodoform gauze. The packing was changed every forty-eight hours for eight days, after which the lateral openings closed by granulation. The sutures were removed on the sixteenth day. Union was complete. Figures 19 and 20 show the condition of the palate two months after operation. The patient is receiving special training for the correction of her speech defect, and already shows wonderful improvement.

Secondary Repair of Harelip.—Case VI (Fig. 21) shows a case twenty years old, who was operated upon when eight months old for correction of complete double harelip. (There was no cleft in alveolar process or palate.)

The result, as regards the floor and the alæ of the nostrils, was good, but the protruding philtrum and the median notch in the lip were decidedly disfiguring. Correction of the deformity required incisions to again convert it into a complete double harelip. Points for determining the lines of incision were located by modifying the Thompson method, taking as a starting point here the mid-point of the junction between the philtrum and the columella (instead of the usual mid-point of the floor of the nostrils). The distance was taken with the calipers from this location to the point where the free edge of the lip should normally be in the lid-line. With this fixed radius, an arc was described and the points marked where the arc crossed the vermilion borders. Incisions were carried through the entire thickness of the lip from the apex of the notch in the free margin of the centre of the lip to the apex of the philtrum, then laterally to the marked point immediately above the vermilion border and thence to the sides of the base of the philtrum. Corresponding incisions were made on the opposite side. The philtrum was then trimmed to a "V" shape. The tissue taken away by these incisions removed practically all the old scar tissue. The margins were then approximated as in closing an original double harelip, but using special care to bring the skin margins of the philtrum and the lip to the same level. Most of the sutures were placed in the muscle tissue and on the mucous membrane surface. A few fine interrupted silk sutures, alternating with horse-hair, were used on the skin surface. All skin sutures were removed by the fifth day. No dressings were applied at any time. The external and the internal surfaces of the lip were simply cleansed three times a day with boric acid solution, the skin surface dried and aristol powder lightly applied over the suture line. After the sutures were removed, sterile vaseline was applied over the area each night for a month. The very small amount of scar tissue which resulted and the contour of the lip after operation are shown in Fig. 22.

OPERATIVE TREATMENT OF COMPLETE DOUBLE HARELIP

By VICTOR VEAU, M.D.

OF PARIS, FRANCE

SURGEON OF THE FOUNDLING HOSPITAL

IN the article by James E. Thompson in the *ANNALS OF SURGERY* of October, 1921, are given some very good photographs for which he is to be thanked, because such documents are rare on this subject. These photographs, however, show that his technic is open to the same reproaches as we have already addressed to the French surgeons. I thank the Editor of the *ANNALS* for accepting the following remarks. They are the summary of a more extended work written in collaboration with my pupil Lascombe and published in the *Journal de Chirurgie* of February, 1922.

Since the year 1906, I have seen in the Foundling Hospital thirty-five cases of complete double harelip which have either been operated upon for the first time or retouched.

Thompson rightly condemns the excision of the premaxilla. The photograph (Fig. 1) shows the bad results obtained by this method. But when the premaxilla is preserved, a sufficient projection must be given to the upper lip. It is to avoid this ugly profile that I have devised the following process, which is not original, for in it are combined different technics.

I always begin by operating upon the lip. The palate is only sewn later on. I have always closed the lip by two operations: 1st, by the pulling back



FIG. 1.—Young girl fourteen years of age, who has undergone the extirpation of the premaxilla when ten months old.

of the premaxilla; 2nd, definitive suture of the soft parts. This method is much less dangerous and gives better æsthetical results than that which consists in making only one operation.

Age.—I pull back the premaxilla at the age of two or three months. I sew the lip one month or two later. The palate will be closed during the second year. It is very important that the children should be operated only when they are in good health. The temperature must be taken during several

days. The skin must be very healthy. The nose must not run.

First Operation.—The pulling back of the premaxilla. The premaxilla must never be taken away. The bone and the soft parts are indispensable to the reconstruction of the lip. In pulling back the premaxilla (Fig. 3), the surgeon must pay attention not to flatten the nose. The obstacle to the

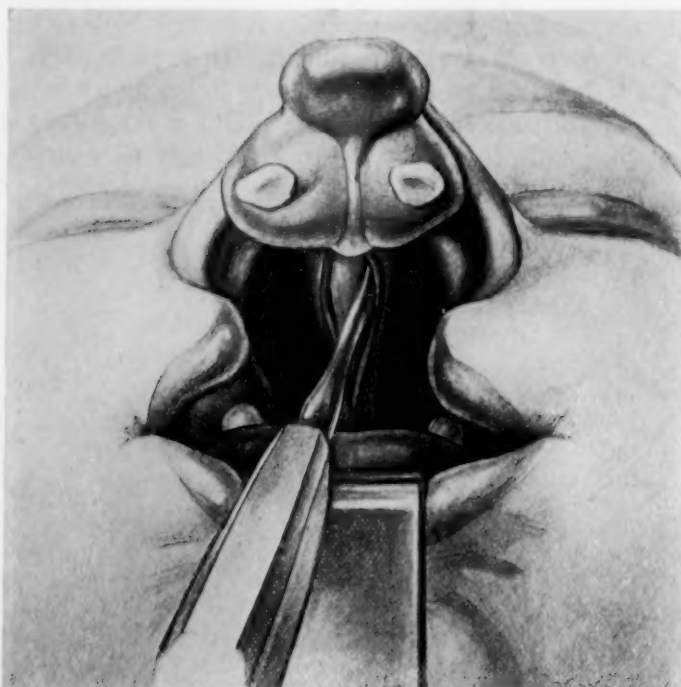


FIG. 2.—Loosening up the periosteum of the septum nasi after incising the mucosa.

pulling back is the septum. It would be rational to make a section, or better still, a triangular resection (Blandin, Mirault) of the septum. But the projection of the nose depends upon the integrity of the septum, any resection of this bone will flatten the nose in a very ugly manner. The neck of the bone must be cut horizontally. The columella will be naturally reconstituted.

Technic.—A. *The incision of the mucosa of the periosteum of the lower edge of the septum.* It is two centimetres long, it reaches the posterior side of the premaxilla. The hemorrhage is insignificant (Fig. 2).

B. *The elevation of the periosteum.* This part of the operation would be easy because the periosteum does not adhere to the bone, but the lower edge of the septum is very much enlarged, the prominence must be turned away from it. This loosening must above all be done in front towards the columella.

The section of the neck of the bone (Fig. 4) must be very carefully done,

TREATMENT OF COMPLETE DOUBLE HARELIP

a sharp pair of forceps are employed, a piece of bone must often be taken away in order to see more clearly what is being done. It is very important to pull back the premaxilla in a lump as a drawer is closed and not to turn it round an upper horizontal axis like a door that is shut. The incisor teeth must remain quite vertical and not oblique behind, a common mistake, nor horizontal as we have seen.

As to the incision made on the lower edge of the septum it is not necessary to sew it, it will close very quickly alone.

C. *The fixing of the drawn-back premaxilla.* A perforator is introduced as it is represented in Fig. 5, then it is raised and pushed back (Fig. 6). It brings back with it a double silver thread. After the section of the loop there is a double right thread and a double left thread.

For fear lest the tightening of the silver thread should cause necrosis of the anterior mucosa of the premaxilla, I am accustomed to bring back each anterior thread on the lateral parts following the manner indicated in Fig. 7.

The external point of support must be found on the maxillary process, the perforator is introduced

at five or eight millimetres from the anterior end of the point of the bone, it crosses it and brings back the posterior thread of the corresponding one. When the threads are knotted the premaxilla is fixed (Fig. 8).

If the premaxilla has a larger width than the space between the maxillary processes, the teeth of the premaxilla must be taken away. If, on the contrary, the premaxilla is much smaller, it must be carried into contact with one of the edges.

To facilitate the fusion of the bones it is well to lay bare the contiguous surface by taking away a piece of the mucosa, as it is represented in Fig. 8, but one must not count too much upon this fusion. I have only observed it once.

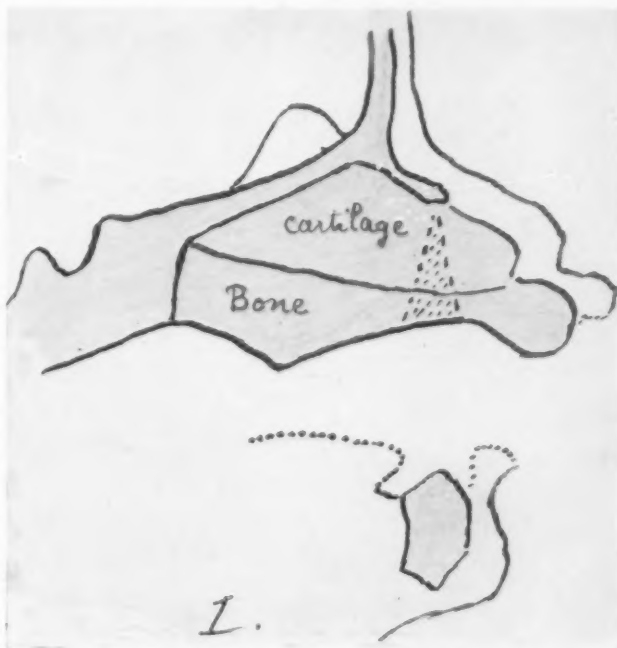


FIG. 3.—(1) Septum of a child three months old having a complete double harelip.

D. *The bringing together of the lip.* We do not try to make a completely restored lip, our only object is to create a bond of the soft parts in front of the drawn back premaxilla. I think that this means of fixing the premaxilla is much more important than the deep ligature by the silver thread.

The two mucocutaneous edges are refreshed as represented in Fig. 9. The skin is sutured. My custom is to place a vertical silver thread which takes the whole of the lip (Fig. 10) and which is knotted to the lower part. This thread generally cuts the mucosa, but that is of no importance, because the scars of the mucosa are never apparent.

Care After the Operation.—It is most important to prevent the child from touching the operated part. This is easily done by introducing between the upper limbs of the child and his night-gown a cardboard roll which goes from the shoulder to the wrist and prevents the movement of the elbow; this cardboard must be fixed with a safety-pin to the night-gown to prevent its coming down.

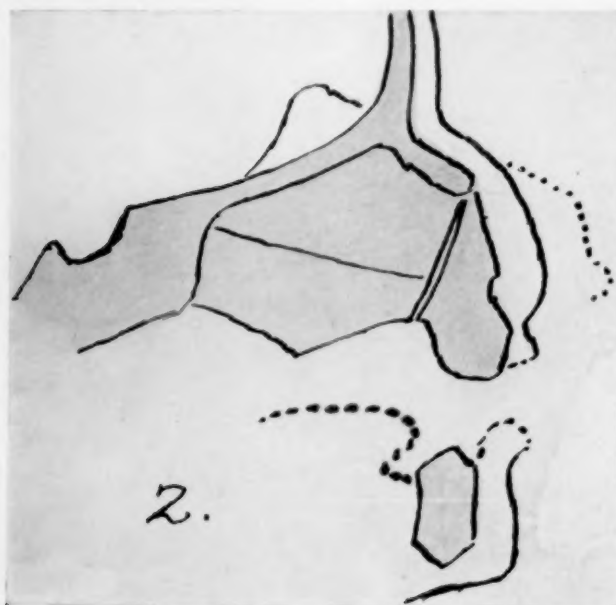


FIG. 3.—(2) Triangular resection showing how the projection of the nose is effaced after the pulling back. Process that must not be employed.

closed. (2) The cutaneomucous line must be rectangular. (3) The muscles of the philtrum must be very living, to assure the continuity of the orbicular. (4) The mucosa must be quite apparent, projecting, without a notch in its lower edge. (5) The totality of the lip must be neither restrained nor flattened.

The remaking of the lip will have for object to reconstitute the three elements of the region—skin, muscle, mucosa.

1. *The Skin.*—The easy part—all processes are good, all the incisions can be utilized. It is of first importance to make the incision in the skin itself, but away from the mucosa to avoid with certainty the piece of mucous mem-

Second Operation.
—Restoration of the lip. The qualities of a well-restored lip: (1) The cutaneous part must be supple; no piece of mucous membrane must be en-

TREATMENT OF COMPLETE DOUBLE HARELIP

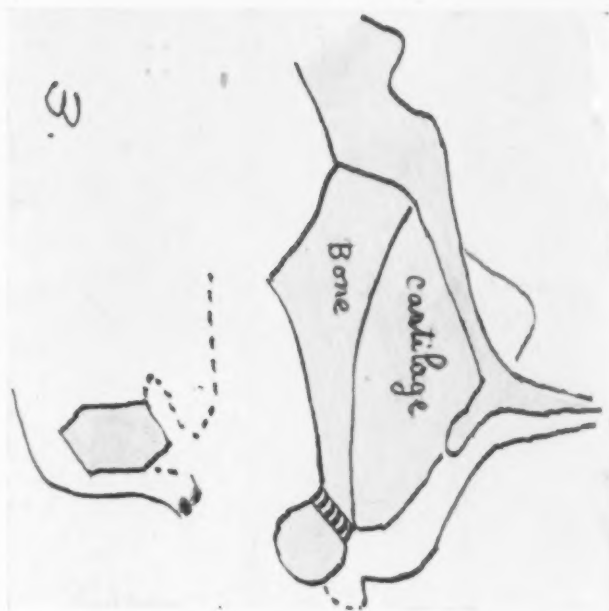


FIG. 3.—(3) Good incision of the neck of the bone of the premaxilla. the projection of the nose is not modified.

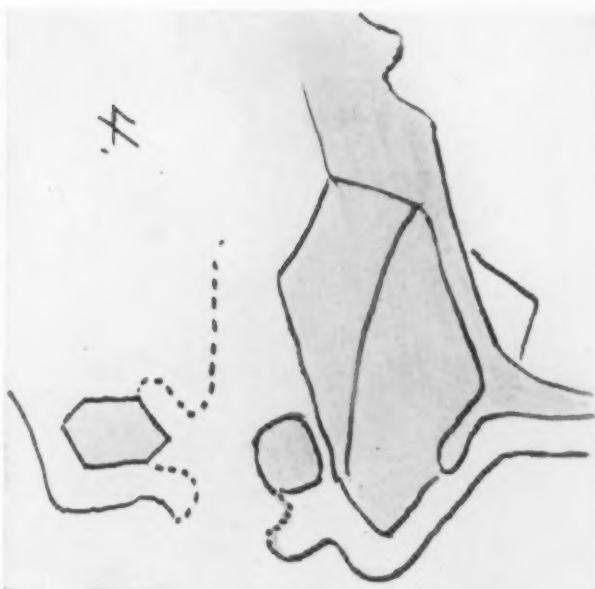


FIG. 3.—(4) Showing how the mucosa of the lower edge of the premaxilla will constitute a deep layer for the flat pieces of the skin sutured on the median line.

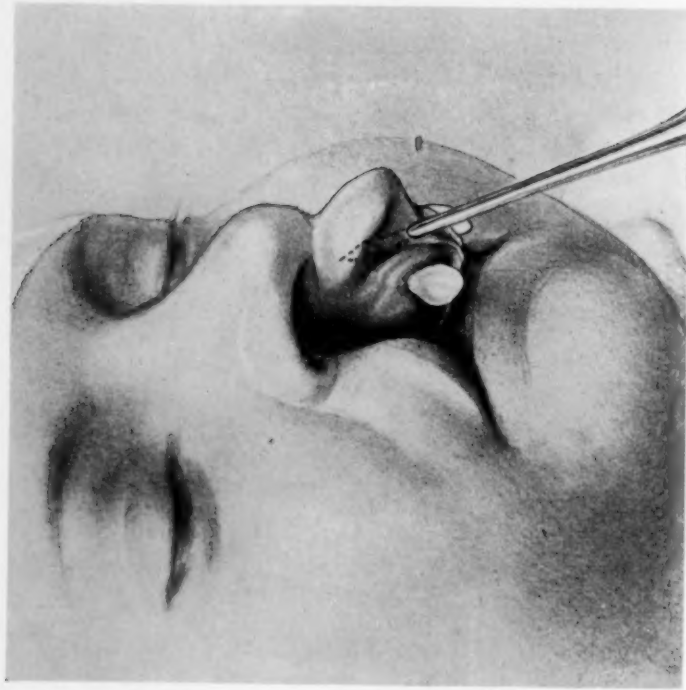


FIG. 5.—Fixation of the premaxilla. The perforator is introduced between the bone and the soft parts and is directed toward the columella.

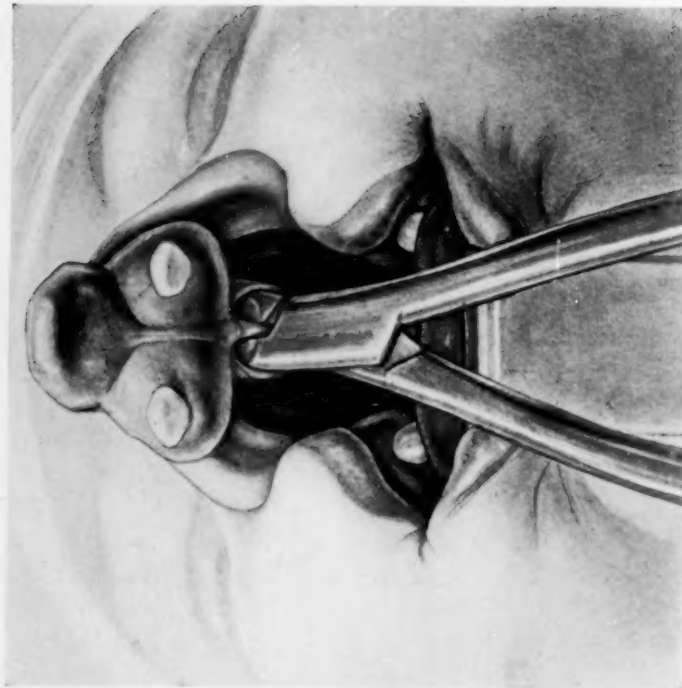


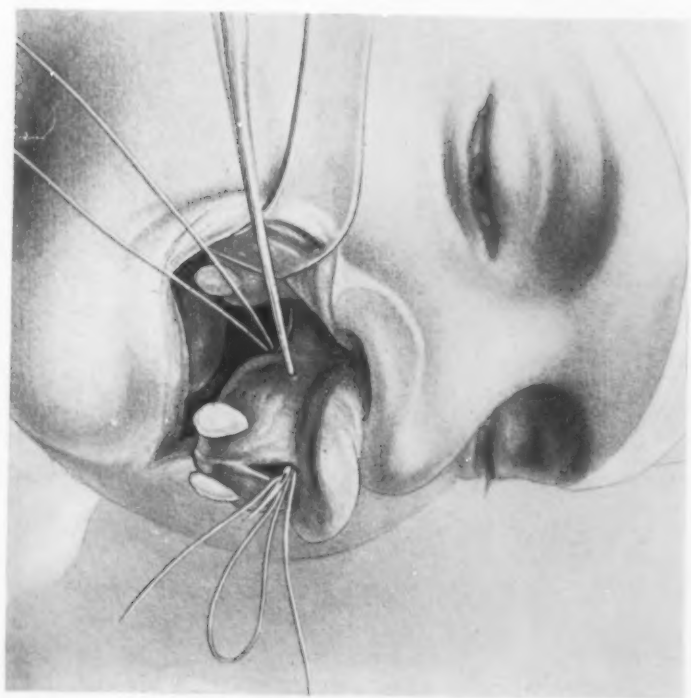
FIG. 4.—Section of the neck of the premaxilla.

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FIG. 6.—The perforator is raised, its point is pushed back behind the premaxilla and threaded with a silver thread at its point.



FIG. 7.—One of the threads is drawn back to the side.



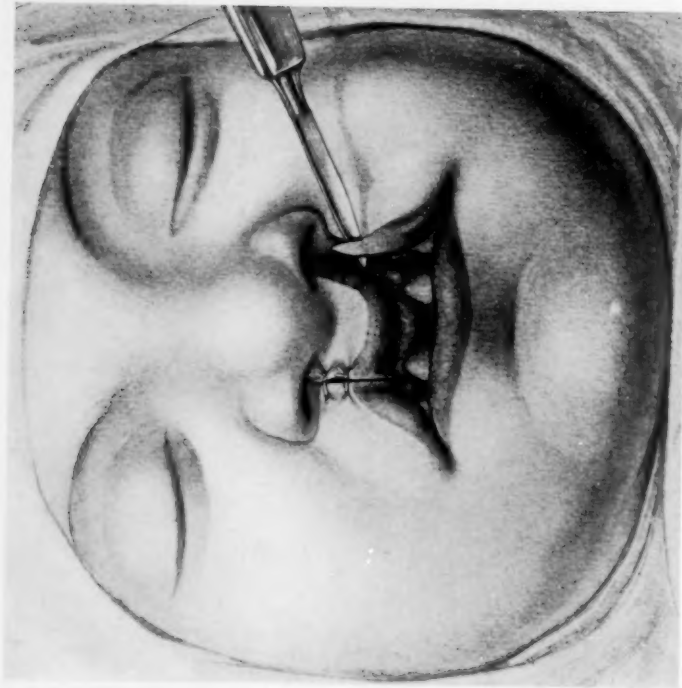


FIG. 9.—Refreshing the mucocutaneous edge of the lip.

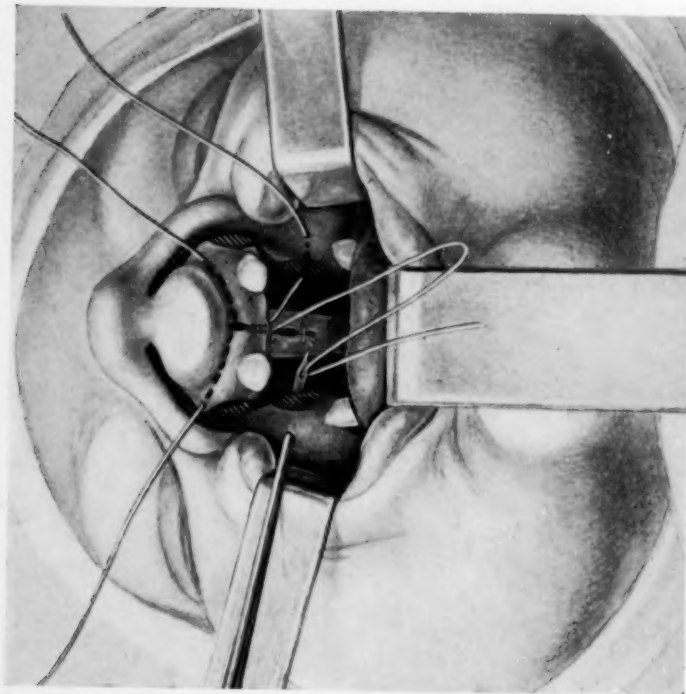


FIG. 8.—The silver threads are passed into the maxillary process.

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FIG. 10.—The skin suture. Note the through transverse suture performing all the elements of the lip involved.

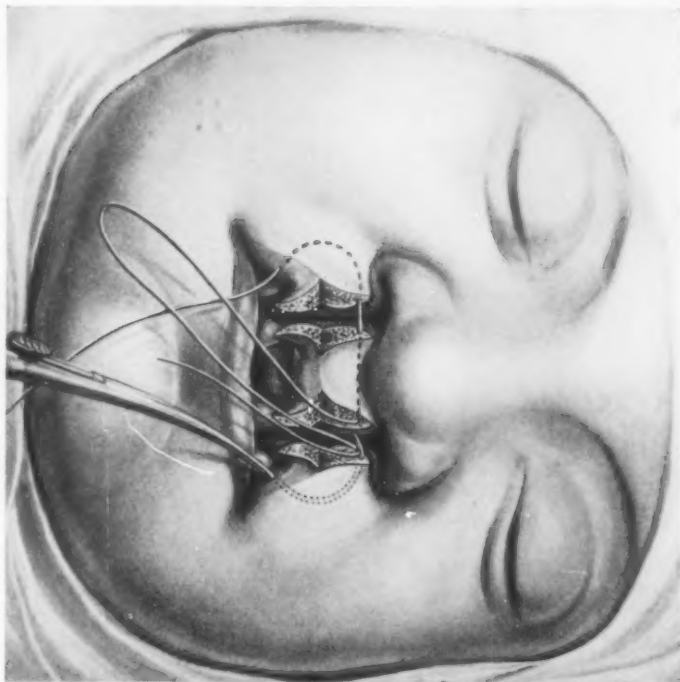
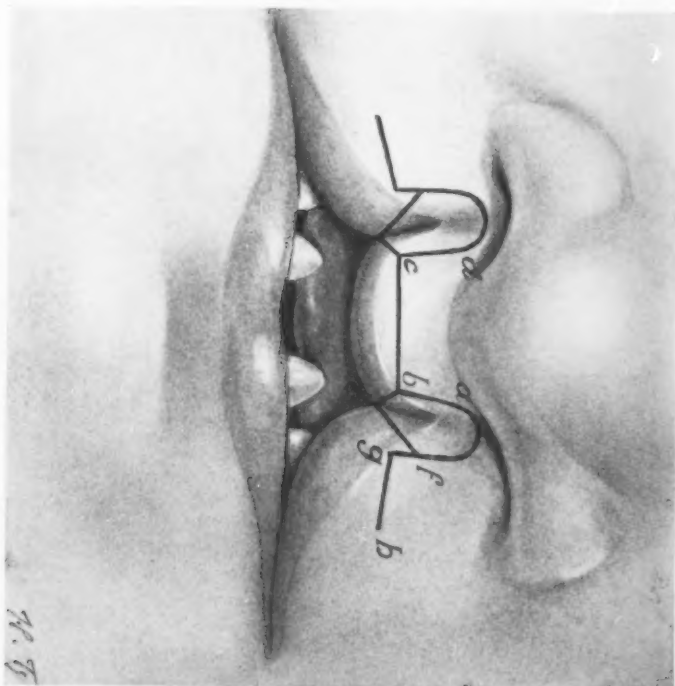


FIG. 11.—Second operation. The skin incisions.



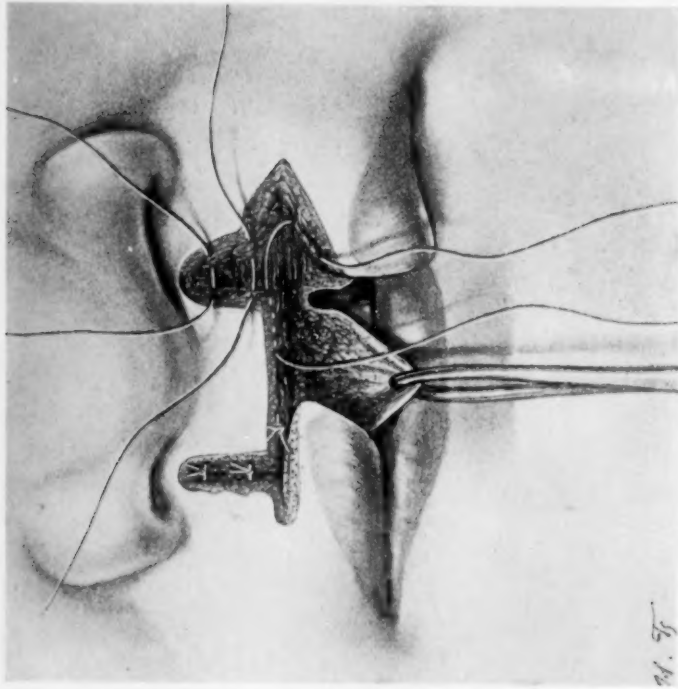


FIG. 13. The suture of the muscles.

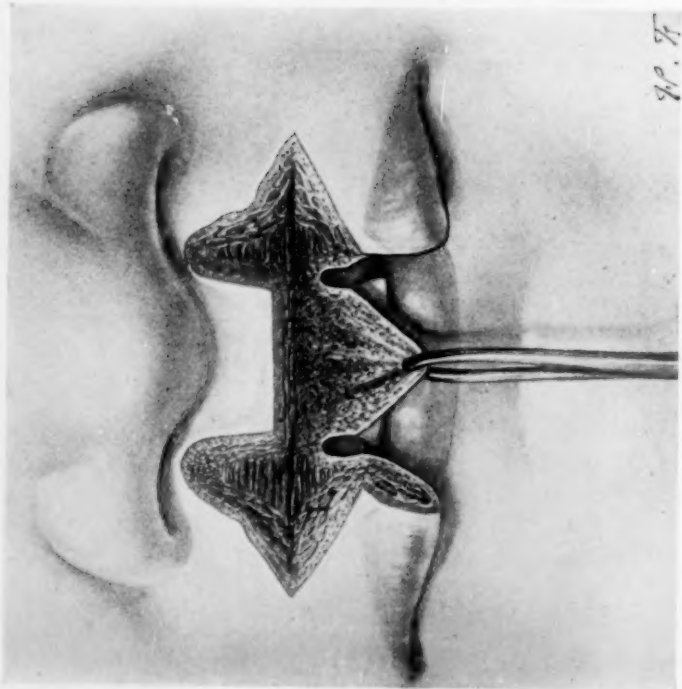


FIG. 12.—The skin incisions completely exposing the muscular elements of the lip which are to be carefully conserved.

TREATMENT OF COMPLETE DOUBLE HARELIP

FIG. 14.—The suture of the skin. The important first stitch placed accurately on the mucocutaneous line.

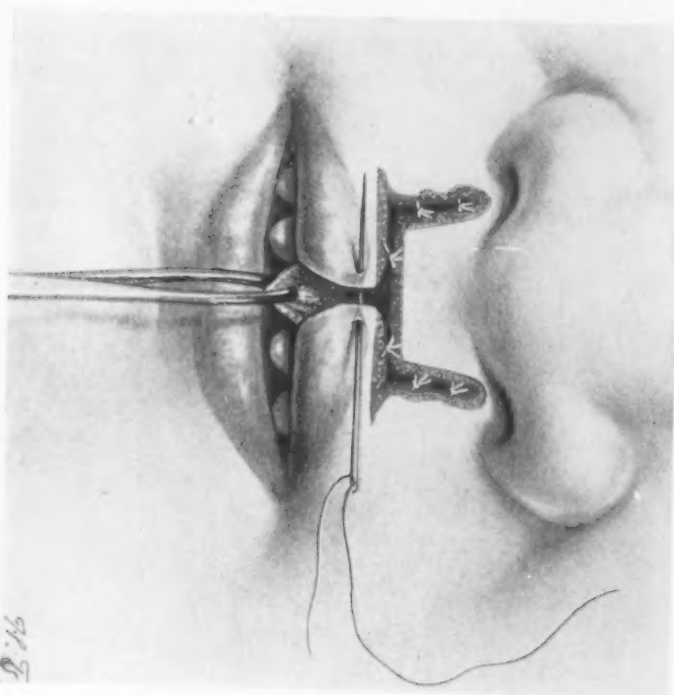
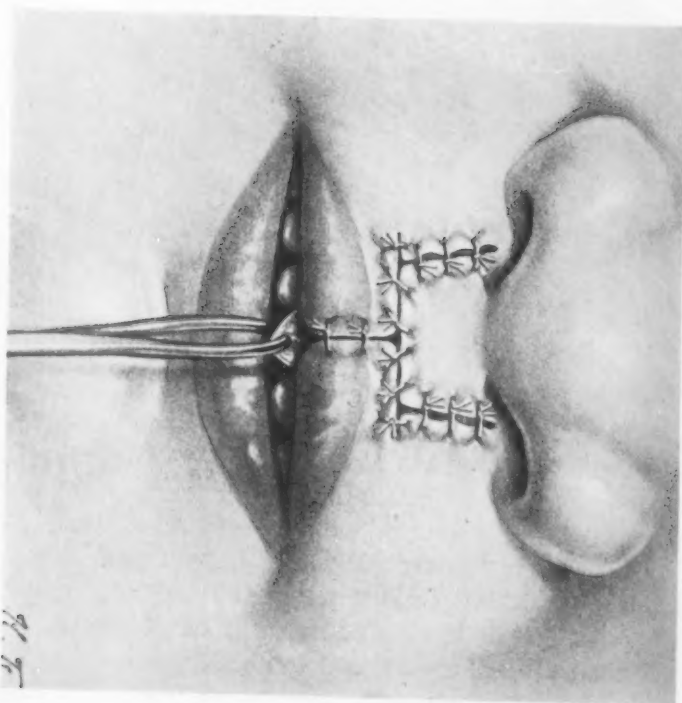


FIG. 15.—The suture of the skin completed.



brane that remains, which is a very great mistake. The lip is nearly always too high because the atrophied philtrum becomes larger afterwards.

2. *The Muscles.*—The most important part—they must be reconstituted carefully to give the suppleness of the lip.

3. *The Mucous Membrane.*—The difficult part. The taking away of the mucosa of the philtrum is the chief fault of the classical operation (Fig. 2). It is the lack of mucous membrane that gives the flattening of the lip. Ferguson has not fallen into the classical error.

Technic.—Figure 11 indicates the line of incision. With the bistoury you trace the line c.b. in taking great care: (a) that this line passes away

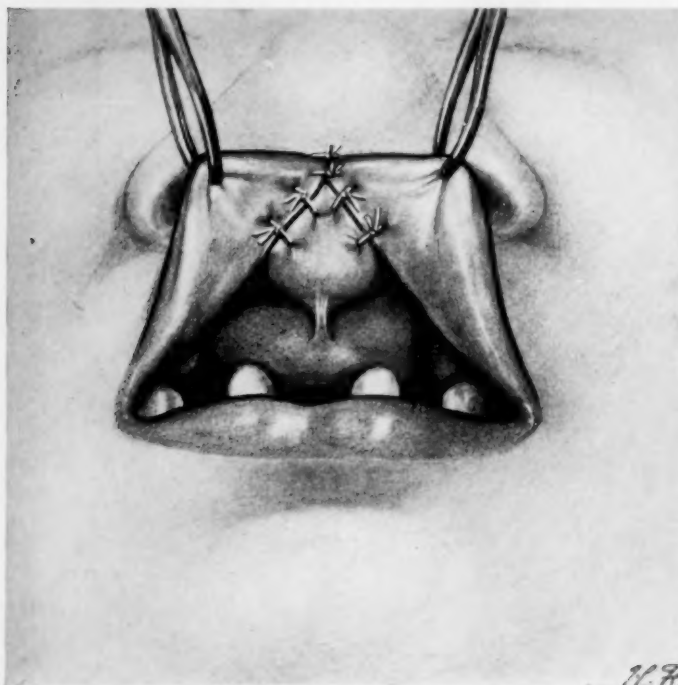


FIG. 16.— The suture of the mucous membrane. Note especially the manner in which the philtrum is included in the suture.

from the mucous part, (b) that the bistoury only cuts the skin, (c) that the angles b.c. are very clearly cut at right angles.

At the level of the lower edge of the philtrum the totality of the muscle must be conserved (Fig. 12).

The cutting of the lateral part is done in commencing by the line e.f. which includes the whole of the mucous membrane with about

two millimetres more of skin. It must be perpendicular in the direction of the lip. The incision will include the inner and outer mucous membrane. When the bistoury arrives at the point f. it makes the line f.g. three millimetres long which approaches the cutaneomucous line, but must never cut this line. This little angle will give to the median part of the lip a slight bend which will especially contribute to its beauty.

The line g.h. will be drawn obliquely in leaving progressively the mucous membrane. Its length has no importance; its object is to diminish the tension of the suture of the skin; it can be lengthened afterwards.

After having cut one side, the other is cut. It is very important that

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the two lines f.g. have the same length. The lines g.h. can have different lengths.

The part included between the points b.a.f. will be taken away, taking great care to penetrate into the nostril in order to diminish the spreading out of the nose to be certain that the whole of the mucous membrane is taken away, but the buccal mucosa must not be cut.

When all the incisions are traced, you have the large wound represented by Fig. 12. A pair of forceps are placed on the mesial part of the philtrum, which is drawn into a triangle because it is very elastic.

(c) *The suture of the muscles* (Fig. 13) must be done with great care on the lateral parts and on the lower part to give homogeneity to the lip. I employ the finest catgut.

(d) *The Suture of the Skin*.—At this moment the edges are in contact. The suture must be made with the greatest precision. I employ Carrell's needles and vascular silk. The first stitch is the most important (Fig. 14); it must be placed exactly on the cutaneomucous line. The lower edge of the

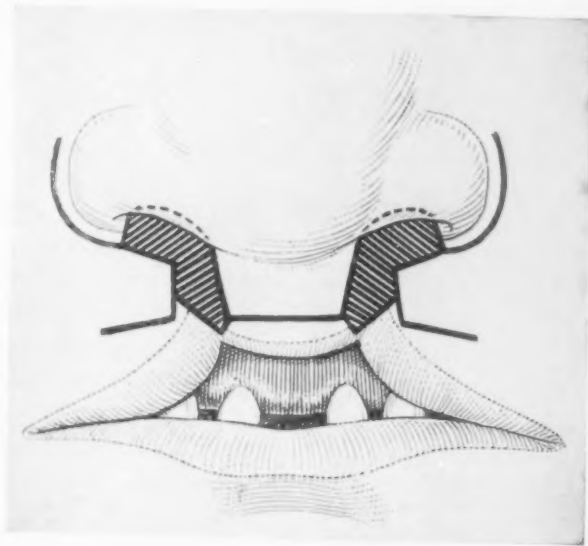


FIG. 17.—The correcting of the spreading-out of the nostrils, incision of the nose combined with the incision of the lip.

philtrum will be stitched afterwards, and, lastly of all, the lateral parts.

Generally the tension of the lip is such that the end h. of the lateral incision (Fig. 11) comes into contact with the lower lateral stitch of the philtrum, b. It is often unnecessary to make the vertical stitch represented by Fig. 15.

(e) *Suture of the Mucous Membrane*.—I employ fine horsehair, but these sutures have not the importance of the sutures of the skin, because there is no apparent scar on the mucous membrane. You can always put two stitches on the extremity of the side pieces of skin; they must be deep, taking in muscle which is underneath.

The lower part of the philtrum, which is situated behind, must be sewn as it is represented in Fig. 16.

To fight against the traction, I am accustomed to place a silver thread across the lip as is shown in Fig. 10.

The consecutive care will be the same as that given after the first operation.

Accidents—Imperfections.—*Disunion* is observed sometimes after the first operation. Nearly always it is produced on one side. A few months after a new suture is made.

The spreading out of the nostril is an almost inevitable accident. When it is not too noticeable it can be left. But sometimes it is very ugly; it should then be remedied by a second operation. It is sufficient to trace the incision as it is represented in Fig. 17.

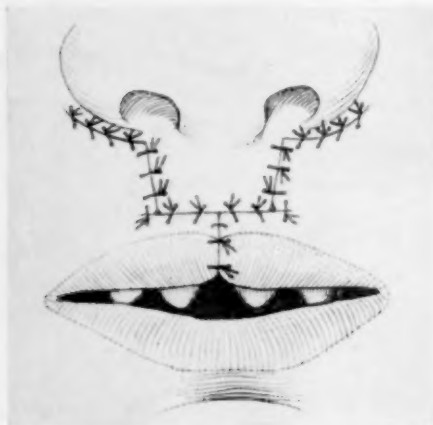


FIG. 18.—The suture of the incisions of the nose and the lip.

If it is produced after the second operation, it is necessary to operate again to bring it inside to the edge of the nostril by tracing a piece of skin as it is shown by the same figure.

The median notch of the lower edge of the lip has often been observed by me before placing the big silver thread (Fig. 11). It is easy to correct by a slight operation.

The surgeon must not neglect the ultimate treatment of his patient. The phonation will be much ameliorated in giving to the lip a sufficient suppleness by massage by spontaneous movement. The mastication is

always defective because the teeth of the premaxilla cannot be used; it is necessary to wear an apparatus.

EXPERIMENTAL RECONSTRUCTION OF THE ŒSOPHAGUS WITH AUTOGENOUS FASCIA LATA TRANSPLANTS

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A MOST important factor in surgery of the œsophagus is infection. It merits emphasis. The explanation for this is anatomical—the œsophagus traverses the mediastinum. The fascial planes and structures which surround the œsophagus tend to parallel it. It follows, therefore, that it is the rule for an infection along any part of the œsophagus to lead to a mediastinitis or to a mediastinitis associated with a general empyema. This is usually fatal.

The sources of this infection are two-fold; first, autoinfection from the epithelial surfaces which must be dealt with in the various procedures of œsophagoplasty; second, from the external sources conveniently termed "faulty technic." Of these two sources, first mention belongs to autoinfection.

I. *Autoinfection*.—(a) The chief source of autoinfection is from the epithelium lining the œsophagus—in other words, *leakage of the contents of the œsophagus*. Whether this leakage takes place at the time of operation or subsequently, the result is the same—infection. C. H. Mayo,²⁴ J. B. Murphy,²⁸ Bevan⁵ and others have directed our attention to the necessity for avoidance of opening the œsophagus in the comparatively simple operation for diverticulum. The recognition of the importance of autoinfection here has changed the risk in this operation sufficiently to remove it from the class of the hazardous to that of the safer operations.

The importance of autoinfection is equally true with resection of the œsophagus for carcinoma, yet the majority of the usual operative procedures for the reconstruction of the œsophagus contemplate not only resection of a portion of the lumen of the œsophagus, but also a further handling of these remaining cut ends in the transplanting of them from an intra- to an extra-thoracic position. This soiling of the operative field has been only too frequently followed by a mediastinitis and death.

Willy Meyer²⁵ noted the presence of "infected serosanguinolent exudate" which he had observed post-mortem in the mediastinum and pleural cavities after resection and transplantation of the thoracic œsophagus. Here special mention was made of the observance of "perfect asepsis" at operation. It is entirely probable that the infection which occurred was the result of opening the lumen of the œsophagus and further manipulation of these cut ends with the consequent unavoidable soiling of the field. This in spite of the diligence of one of our most careful surgeons.

(b) Another source of autoinfection is from the transplants of epithelial lined tubes of the viscera or the entire viscus which is to replace the resected

portion of the œsophagus. These are never sterile. This fact has been largely responsible for the development of extrathoracic œsophagoplasty whereby the potential infection is brought nearer the surface and into a far less vital region.

It is impossible, of course, to remove a cancerous growth of the œsophagus surgically without opening the lumen of the œsophagus; but it is possible to avoid all handling of these cut ends and all soiling of the field of operation by the contents of the œsophagus both at the time of operation and subsequently. Moreover, it is possible to avoid the use of unsterile epithelial grafts in the reconstruction of the defect produced by resection of a portion of the œsophagus.

These points are emphasized in an operative procedure which we have worked out experimentally and will be discussed later.

II. *Faulty Technic.*—(a) The second possible source of infection we will place under the elastic caption of faulty technic. The fact that infection of the tissues surrounding the œsophagus is attended by such grave results makes it ultra-imperative that the *best* rules of aseptic surgery be strictly observed. We are wont to consider this aseptic technic as being best exemplified in "no hand touch" surgery. This should be observed insofar as it is possible.

It is not our intention to outline the principles of "no hand touch" surgery—that is common knowledge



FIG. 1.—A photograph of the epithelial surface of a 47-day dog resection, semi-circumference, with fascia lata transplant. Note that the suture line is outlined by ulcerations and that the linen suture remains. The epithelium has grown over the defect.

—but we would like to present a refinement for this technic. In our work we found it desirable to use the single suture. This we were unable to do without handling the suture needle with the gloves. To overcome this we then designed a needle which would not become unthreaded.¹ The needle can be easily threaded with the forceps; and in sewing it is found to lend itself readily to handling by forceps alone. All knots are tied with forceps.

The operation for resection and reconstruction of the œsophagus is in its infancy. In the literature one cannot fail to be impressed by the recent dates of all experimental data and case reports. The greater majority of these have been reported within the last fifteen years. There have been, however, a large number of operations devised to accomplish this result. None of these is entirely satisfactory.

RECONSTRUCTION OF THE ŒSOPHAGUS

For the sake of brevity, the basic operative procedures which have been devised for œsophagoplasty will be tabulated without discussion.*

- (1) Cervical œsophagoplasty by means of *skin-plasty* (v. Hacker, 1886).¹⁸
- (2) Extrathoracic œsophagoplasty by means of *skin-plasty* of neck and anterior thorax (H. Bircher, 1894).⁶
- (3) Inferior extrathoracic œsophagoplasty by use of a *portion of the jejunum* (Roux, 1907).³³
- (4) Inferior extrathoracic œsophagoplasty by use of a *portion of the jejunum and skin-plasty* (Wullstein, 1904).³⁰
- (5) Inferior extrathoracic œsophagoplasty by use of a *portion of the transverse colon* (Kelling, 1911²¹ and Vulliet, 1911).³⁸
- (6) Inferior intrathoracic œsophagoplasty by use of the *stomach* (Sauerbruch, 1905).³⁴
- (7) Inferior extrathoracic œsophagoplasty by use of a *tube of the anterior wall of the stomach* (Hirsch, 1911).¹⁸
- (8) Inferior extrathoracic œsophagoplasty by use of a *tube of the greater curvature of the stomach* (Beck, 1904,³ Jiänu, 1912).¹⁹
- (9) Inferior extrathoracic œsophagoplasty by use of the *first horizontal portion of the duodenum* (v. Fink, 1913).⁹

Reconstruction of half the circumference of the œsophagus with fascia has been done by Razzaboni and Neuhof.

- (1) Cervical œsophagoplasty by use of the *sheath of the rectus and peritoneum* (Razzaboni, 1917).³¹
 - (2) Cervical œsophagoplasty by use of the *fascia lata* (Neuhof, 1917).²⁹
- The procedures devised by Wullstein (No. 4) and by Beck and Jiänu (No. 8) have been the most popular. All the procedures for the reconstruc-



FIG. 2.—A microphotograph from the edge of an ulceration shown in Fig. 1. The linen suture marks the edge of the growing epithelium.

* Since writing this article, our attention has been called to an excellent case report and new two-stage procedure for resection of the œsophagus, described by Dr. Howard Lilienthal, *ANNALS OF SURGERY*, vol. lxxiv, pp. 259-279, 1921. Skin flaps are used instead of fascia, and the œsophagus is approached through the posterior mediastinum.

tion of the entire lumen of the œsophagus have three undesirable features in common. They are complicated for execution; they require months for completion; and they are attended by a high mortality.

We believed there was a need for a more reliable, less complex procedure for reconstruction of the œsophagus. This seemed worthy of experimental investigation.

The material of choice for repair of defects in the œsophagus must possess a considerable amount of strength, must be pliable and must lend itself to transplantation. The epithelium and tubular viscera have these requirements, but they are unsterile; fascia possesses these requirements, is sterile, and in addition will unite firmly and readily with the muscular wall or, more specifically, with the adventitious layer of the muscular wall of the œsophagus.

Neuhof²⁰ and Razzaboni³¹ have used fascia to repair experimental defects of the œsophagus in the dog. Neuhof sutured the fascia lata into the defects; Razzaboni filled in the defects of the œsophagus with a double layer of the inner sheath of the rectus and its peritoneum. Each succeeded in repairing defects of approximately half the circumference, but neither reconstructed the entire circumference of the œsophagus. Neuhof found slight stenosis in his younger experiments and still less stenosis in the older experiments; Razzaboni found marked stenosis in all his experiments.



FIG. 3.—A photograph of the interior of the œsophagus with resection of half the circumference. Sutured with oo plain catgut with loosening of fascia. Marked stenosis.

PLAN

We hoped to be able to work out first the cause or causes for the differences in the degree of stenosis, then to work out a safe method for reconstructing the entire circumference of the œsophagus with fascia lata. We considered it best to reconstruct first the semicircumference of the œsophagus in its cervical portion, then in its thoracic portion. Both the successful and the non-successful experiments were to receive close study. Later we were to attempt the reconstruction of the entire circumference of the œsophagus with the fascia lata. Our experiments and ideas have, therefore, been of a progressive type and our results will be presented in like manner.

Experiment A.—The procedure in the cervical series of semicircumference resection is as follows, as carried out on the dog:

RECONSTRUCTION OF THE OESOPHAGUS

June 13, 1918: Experiment A 1. Under aseptic conditions and with ether anaesthesia, a midline incision is made in the neck. The ribbon muscles are easily separated and the trachea is exposed. This is pulled to the right and the oesophagus is seen immediately behind. The oesophagus is grasped by forceps and is dissected out by gauze dissection. All the fascia lata is removed. It forms a rough rectangle about six by three cm. It is handled by small forceps at each of the four corners. The oesophagus is again picked up and two pairs of rubber-jacketed intestinal clamps are applied about 8 cm. apart. The field is packed off with gauze. Half the circumference of the oesophagus is resected for the length of 5 cm. The strip of fascia lata is brought into this defect and sutured in place with linen. A running mattress suture is used so as to bring the mucosa to lie against the fascia. This slightly everts the mucosa. The suture takes in all the walls of the oesophagus.

June 14, 1918:
Dog listless. Nothing
by mouth. Morphia
freely.

June 15, 1918:
More active, notices
his surroundings.
Water and milk by
mouth. Neck swollen.

June 18, 1918:
Liquid foods. Neck
looks good.

July 3, 1918: Eats
ordinary foods.

July 30: Killed at
forty-seven days. Au-
topsy; The neck
wound healed by first
intention. The oesoph-
agus is moderately
firmly adherent to the
trachea and there are adhesions to the surrounding tissues of the neck. The oesophagus easily admits the forefinger. When split open, the defect in the wall of the oesophagus is seen outlined by the uninterrupted linen suture (Fig. 1.) A row of ulcerations marks the presence of this suture. The defect appears to be covered over with new epithelium.

Microscopically: The stratified epithelium covers the entire defect, except for the ulcerations around the suture. The oesophageal muscle ends abruptly on both sides of the defect and between these ends connective tissue is found. There are no oesophageal glands beneath the new epithelium covering the connective tissue. A moderate amount of round and polymorphonuclear cell infiltration is seen throughout the connective tissue.

September 8: Experiment A 21. Usual procedure, except that instead of resection of half the circumference of the oesophagus, three cm. of the entire circumference is resected. The fascia is placed so as to make a tube entirely bridging over the defect. Number 1 hard intestinal catgut suture is used with a



Fig. 4.—A microphotograph of a section taken at "Y", Fig. 3, showing absence of fascia lata transplants. The edges of the normal mucosa have pulled together.

cobbler's stitch. Especial attention to asepsis. Fascial tube two cm. in diameter. Closed without drainage.

September 9: Dog listless. Nothing by mouth. Morphia freely.

September 10: Dog listless. Nothing by mouth; neck swollen.

September 11: Dog listless. Fluctuation in neck. Temperature 105°. Drank a few swallows of water.

September 12: Neck broken open at lower angle. Morphia freely.

September 13: Dog found dead this A.M. Autopsy: Neck full of foul-smelling, thin, creamy fluid—pus. Fascia lata tube entirely gone. There are no adhesions between the œsophagus and surrounding tissues of the neck. Mediastinum filled with the same foul-smelling pus, as are both the pleural cavities.

Diagnosis: Cellulitis of neck, mediastinitis, general empyema.

Microscopical: The mucosa, submucosa and muscle layers of the œsophagus are infiltrated with polymorphonuclear and small round cells. Marked necrosis of muscle and connective tissue at edge of section. No adhesions.

These two experiments are given as examples of the successful and unsuccessful experiments of this series of cervical resection.

Tabulated, the results are as follows:

TABLE I.

No.	Days	Epith. Overgrowths	Adh.	Half or Whole Lumen	Suture	Suture Ulcer	Infect. & Leakage	Killed Died	Solid Liquid Food	Cellul Neck Med is	Empyema	Stricture
1	47	++++	+	H	Linen	++++	O	K	S	O	O	+
2	46	++++	+	H	Catgut	O	O	K	S	O	O	O
3	10	++	+	H	Linen	+++	O	K	S	O	O	O
4	5	O	O	H	Linen	++	++++	D	L	+	++	O
5	32	++++	+	H	BVSilk	+	O	K	S	O	O	+
6	46	++++	+	H	BVSilk	+	O	K	S	O	O	O
7	6	+	O	H	2-20 Cg	+	++++	D	L	+	++	O
8	3	+	+	H	1 plain	+	O	K	L	O	O	O
9	14	++	+	H	Silk	+	O	K	S	O	O	+
10	40	++++	+	H	1 plain	O	O	K	S	O	O	+
11	7	++	O	H	1 plain	+	++++	D	L	+	++	O
12	28	+	+	H	Silk	+++	O	K	S	O	O	O
13	1	O	+	H	BVSilk	+	O	K	L	O	O	O
14	4	?	O	H	BVSilk	+	++++	D	L	+	++	O
15	9	++++	+	H	OOplain	O	O	K	L	O	+	++
16	4	O	O	H	OOplain	+	++++	D	L	+	++	O
17	3	O	O	H	OOplain	+	++++	D	L	+	++	O
18	2	?	+	H	OOplain	O	O	K	L	O	O	O
19	12	++	+	H	OOplain	O	O	K	S	O	O	+
20	21	+++	+	H	1 plain	O	O	K	S	O	O	O
21	5	O	O	H	OOplain	?	++++	D	L	+	++	O
22	14	++	+	H	OOplain	O	O	K	S	O	O	O
23	1	O	O	W	Silk	?	?	K	L	?	O	O
24	4	O	O	W	Linen	+	++++	D	L	+	++	O
25	3	O	O	W	BVSilk	+	++++	D	L	+	++	O
26	5	O	O	W	2-20	O	++++	D	L	+	++	O
27	6	O	O	W	1 plain	O	++++	D	L	+	++	O
28	4	O	O	W	1 plain	O	++++	D	L	+	++	O
29	7	O	O	W	1 plain	O	++++	D	L	+	++	O

Two things are worthy of especial consideration in this series of experiments: First, the processes of repair of the resected and reconstructed œsophagus; and second, the causes for the mortality.

Processes of Repair.—Figure 1 is a photograph of the interior of the œsophagus in experiment A-1 at the end of forty-seven days. The patch of fascia lata is outlined by the linen suture. It is apparent that there is little or no stenosis.

Figure 2 is a microphotograph of a section taken at X. It is to be noted

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that the squamous epithelium of the œsophagus has grown over the transplant; and that the transplant itself has been largely replaced by connective tissue. There is a marked infiltration of round and polymorphonuclear cells. Ulceration is seen about the suture.

There seems to be no escape from the observance of two facts in this experiment: Firstly, that linen should not be used to suture the mucosa of the œsophagus; and secondly, that fascia lata repair of the œsophagus is *not* always accompanied by early stenosis.

Figure 3 is a photograph of the interior of the œsophagus in experiment A-15. 00 plain catgut was used to suture the fascia lata transplant into the œsophagus. At the end of nine days the epithelium has entirely bridged the original three cm. defect! Here is found the *most marked stenosis* of this series.

Figure 4 is a microphotograph of a section taken at Y. No trace of the fascia lata transplant is seen. It could not have been replaced by connective

tissue within nine days. The sequence of events here seems to be that the fascia lata transplant has become detached (and swallowed) after sufficient walling off had taken place to prevent a spread of leakage into the tissues of the neck. This new connective tissue has allowed the cut edges to become closely approximated during the resting period of the œsophagus. As a result, the half circumference of the œsophagus which was originally replaced by three cm. of fascia lata is now replaced by less than one cm. of connective tissue, over which the epithelium has already bridged.

Figure 5 is a photograph of the everted œsophageal mucosa in experiment A-6 at the end of forty-six days. The finest blood-vessel silk was used to suture the fascia lata transplant to the œsophagus. Ulcerations are seen around fragments of this suture material. The œsophagus is dilated with a wisp of cotton. There is but little stenosis.

Figure 6 is a microphotograph from a section of a fourteen-day experiment, A-22, showing the junction of the fascia lata transplant with the normal wall of the œsophagus. *a* is the normal squamous epithelium lining the œsophagus; *b* is the duct of a normal œsophageal gland; *c* is the newly formed epithelium; *d* is the fascia lata which is being rapidly replaced by new connective tissue; *e* is the muscle wall of the œsophagus.

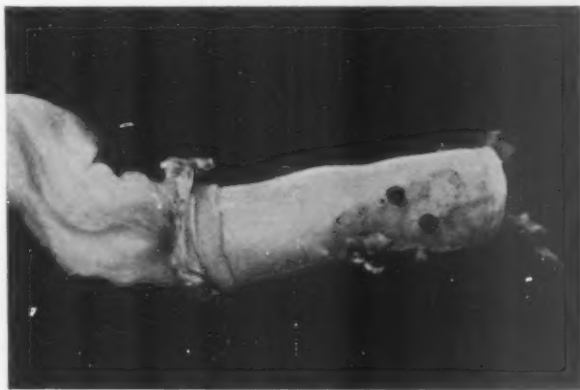


FIG. 5.—Photograph of everted œsophageal mucosa. Note the presence of ulcerations about the finest blood-vessel silk suture.

Figure 7 is a microphotograph from the same section, showing the growing edge of the new epithelium. The distribution of the round and polymorphonuclear cell infiltration is of interest insofar as the section illustrates the rapid disappearance of cell infiltration under the new epithelium. There are no oesophageal glands in the region covered by the newly formed epithelium.

Mortality.—In those animals that died, autopsy invariably revealed a cellulitis of the neck with leakage of the contents of the oesophagus, a mediastinitis, and a double empyema. Any or all of these may have caused death.

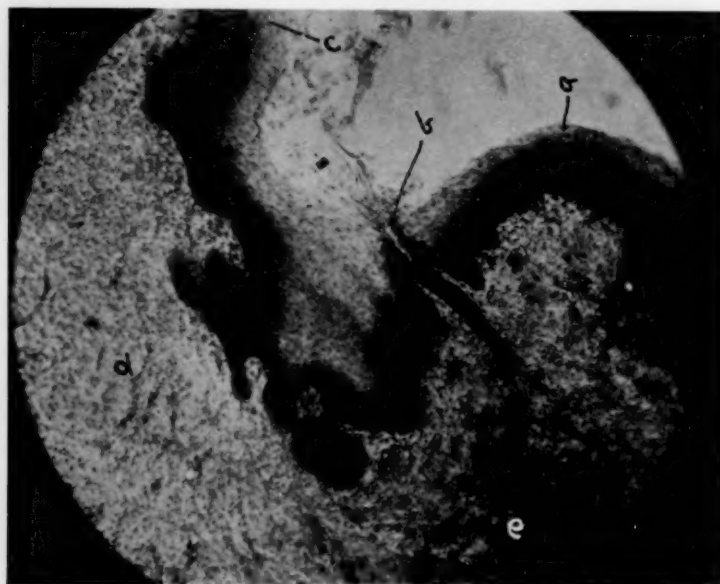


FIG. 6.—A microphotograph of the edge of the resection at the end of 14 days. *a* is the normal squamous epithelium of the oesophagus; *b* is the duct of a normal oesophageal gland; *c* is the newly formed epithelium; *d* is fascia lata and new connective tissue; *e* is the normal muscle wall of the oesophagus.

CONCLUSIONS

From this series of experiments the following conclusions were drawn:

1. That it is possible to repair defects in the wall of the cervical oesophagus by the use of autogenous fascia lata transplants.
2. That the stratified epithelium lining the oesophagus in the dog possesses the power of regeneration to a degree sufficient to enable it to bridge over defects which have been filled in with fascia lata transplants.
3. That infection along the cervical portion of the oesophagus may produce a mediastinitis or a mediastinitis associated with a general empyema.
4. That this infection is accompanied by leakage of the contents of the oesophagus.
5. That silk or linen should not be used for suturing the mucosa.

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6. That stenosis may or may not be found after repair of defects in the wall of the œsophagus with fascia lata transplants.

Experiments, Series AB.—A second series of experiments for reconstruction of the thoracic portion of the œsophagus was then begun. In these it was proposed to carry on the same method of suturing the fascia lata transplant into the œsophageal defect as in the cervical series. The following description gives the general procedure:

September 27,
1918: Experiment AB.

1. Artificial respiration and ether is being given by the Gezell positive pressure apparatus. An incision is made between the seventh and eighth ribs on the left side. Towels to skin. The ribs are spread apart by a rib spreader, the lung is packed away by sheets of vaselined vagus nerves and left silk. The heart, aorta, thoracic duct come into view through the pleura. The pleura is opened laterally to the œsophagus. The œsophagus is easily dissected loose by careful sharp dissection. There is very little bleeding. The chest is allowed to close and the field is covered with a sterile towel.

The fascia lata is removed from the leg. The ribs are spread again. The œsophagus is clamped between two rubber-jacketed intestinal clamps. The field of vaselined silk is packed off with gauze. A section of half the circumference of the œsophagus is removed for a length of 4 cm. The defect is filled in with fascia lata. Cobbler's stitch with No. 2 twenty-day catgut. The mucosa of the œsophagus is slightly everted. The pleura is closed over the œsophagus, bringing the œsophagus again to lie extra-pleurally. Under increased air pressure the lung expands to fill the entire chest. Chest closed air-tight, collodion dressing. Morphia freely.

September 29, 1918: Dog dead this A.M. Autopsy: The mediastinum is full of fluid with hair and debris. Evidently leakage from the œsophagus. The pleural cavities contain the same sour-smelling fluid.

Microscopical: The section shows a general infiltration of round and polymorphonuclear cells. There are no adhesions between the patch of fascia lata and



FIG. 7.—Microphotograph of the growing edge of the epithelium in the same section. Note the rapid disappearance of the round and polymorphonuclear cell infiltration under the new epithelium.

the œsophagus, nor are there any between the fascia and the surrounding tissue. The fascia is lying loosely against the mucosa of the œsophagus, but does not form a water-proof union.

It is highly desirable that we may be able to see and identify readily the various vital structures which are found alongside the œsophagus. None the least important of these is the thoracic duct. This can be visualized by feeding cream one-half hour before operation.

This series of seventeen experiments of intrathoracic resection pursued a uniformly fatal course and need not be tabulated. However, from them we were able to deduce certain conclusions.



FIG. 8.—A microphotograph showing the leak-proof adhesions between the fascia lata transplant and the wall of the œsophagus at the end of 8 days. Resection of the œsophagus can safely be accomplished after these adhesions have formed.

Resection of a few centimetres of the entire circumference in the cervical œsophagus had always proven fatal; and at autopsy infection and leakage had been found. Likewise, the mortality of intrathoracic resection had been one hundred per cent.; and autopsy had revealed infection and leakage. Had the leakage caused the infection, or had the

infection destroyed the fascia to cause the leakage? That we were unable to work out definitely in the cervical series since the animal survived for a period of from three to seven days and at autopsy the fascia was either necrotic or missing.

When, however, intrathoracic resection was done, exitus was found to take place in from twelve hours to two days. In *every* case the mediastinum and pleural cavities contained a large amount of creamy saliva with much detritus—such as hair and small particles of dirt—which could have reached these cavities in only one way—*through leakage of the contents of the œsophagus*. We felt justified, therefore, in concluding that, owing to the short time elapsing between the operation and exitus, infection was not the cause of this leakage; but that leakage of the contents of the œsophagus was an important factor in the production of infection.

Our efforts were then directed toward the prevention of this leakage. Various suture materials ranging from the finest blood-vessel silk to heavy linen, and from oo plain catgut to No. 3—thirty-day chromic catgut, with combinations of all of these into double row sutures, were used. A metal tube was next used, over the grooved ends of which the mucosa of the

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remaining end of the oesophagus was tied with a purse-string suture. The whole repair and metal tube was then enveloped in a fascial sleeve. All of these failed to prevent leakage and infection.

In view of these facts, a careful study of the sections was made to determine, if possible, those factors which had been responsible for the prevention of leakage in the successful cervical experiments. It was seen in every successful early experiment that firm adhesions had quickly taken place between the cut edges of the oesophagus and the fascia lata transplant, or between

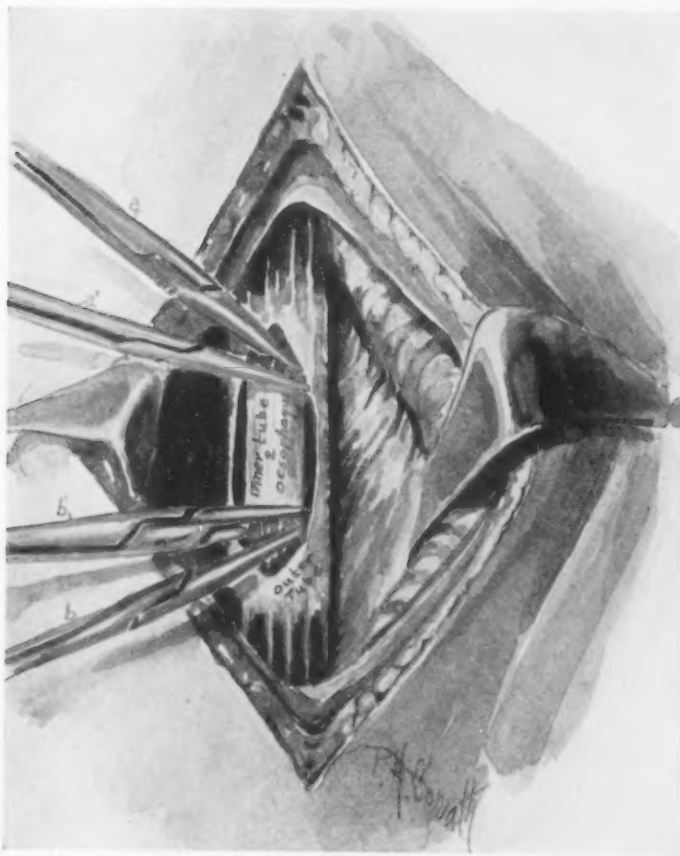


FIG. 9.—A drawing showing technic of removal of a portion of the oesophagus at the second operation. Leakage is guarded against by sewing the split in the outer sleeve of fascia before removal of the clamps a and b which are then removed from between the stitches. The clamp, b, on the distal end of the oesophagus is removed and the small opening here is sutured before the clamp a is removed.

these edges and the surrounding tissues of the neck; and it was apparent in the unsuccessful experiments that adhesions had not formed. It was decided, therefore, to allow these adhesions to form before opening the lumen of the oesophagus. This was to be attempted by a two-stage operation.

Two-stage Operation.—At the first operation two tubes of fascia were

to be placed around the entire circumference of the œsophagus. These were to be superimposed upon each other to form an inner and an outer tube.

The inner tube was to serve only a temporary purpose: to prevent that portion of the œsophagus which was to be removed at the second operation from becoming adherent to the outer tube of fascia lata. It was to envelop only this portion of the œsophagus.

The outer tube of fascia lata was to serve a permanent purpose: to be substituted for the resected lumen of the œsophagus at the second operation. The outer tube of fascia lata was to be longer than the inner tube. The ends



FIG. 10.—A microphotograph showing reinforcement of the suture line in the fascia transplant at the second operation.

of the outer tube might then become adherent to the ends of those portions of the œsophagus which were to be left after resection.

At the second operation the outer fascial tube was to be split longitudinally over that portion of the œsophagus which was to be removed. This portion of the œsophagus along with its adherent inner tube of fascia lata was to be resected. Care was to be exercised to prevent breaking of the adhesions between the ends of the outer tube of fascia lata and the œsophagus. Care was also to be taken to prevent breaking of the adhesions between the outer tube and the tissues of the neck. By these means it was hoped at the second operation to substitute *immediately* a growing tube of fascia lata for the portion of the œsophagus resected, and to prevent soiling and leakage.

This procedure was to be tried out experimentally first in the more accessible cervical œsophagus and later in the thoracic portion of the œsophagus, as in the preceding two series of experiments in which the semicircumference had been reconstructed.

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The procedure in the cervical experiments is as follows:

October 23, 1920: Experiment A-05. Operation No. 1. Under ether anesthesia a midline incision is made in the neck. The œsophagus is dissected out for about 7 cm. The fascia lata is removed from both legs. Two tubes are made from the pieces of fascia and placed around the œsophagus with the muscle side of the fascia in. Care is used to see all of the fat has been removed from the fascia. The ends of the tube are anchored to the œsophagus by interrupted sutures. Two plain catgut. The neck is closed with drainage. Morphia freely.

October 24, 1920:
Drainage tube removed.

November 1, 1920:
Wound healed. Dog fine; can take only liquid food.

November 2, 1920:
Operation No. 2. The fascial tube is identified by its whitish color. It is firmly adherent to the œsophagus—so much so, in fact, that it is difficult to determine just where the ends of the fascial tube are. An incision cuts through the outer tube. The muscle walls of the œsophagus are found. A contraction can be elicited by a sharp prick of the knife. The œsophagus is doubly crushed and clamped at the lower end of the portion to be removed; then two more clamps are firmly applied at the upper end. Excision between both sets of clamps (Fig. 9). (Carbolic and alcohol.) Two plain catgut is used in a cobbler's stitch to

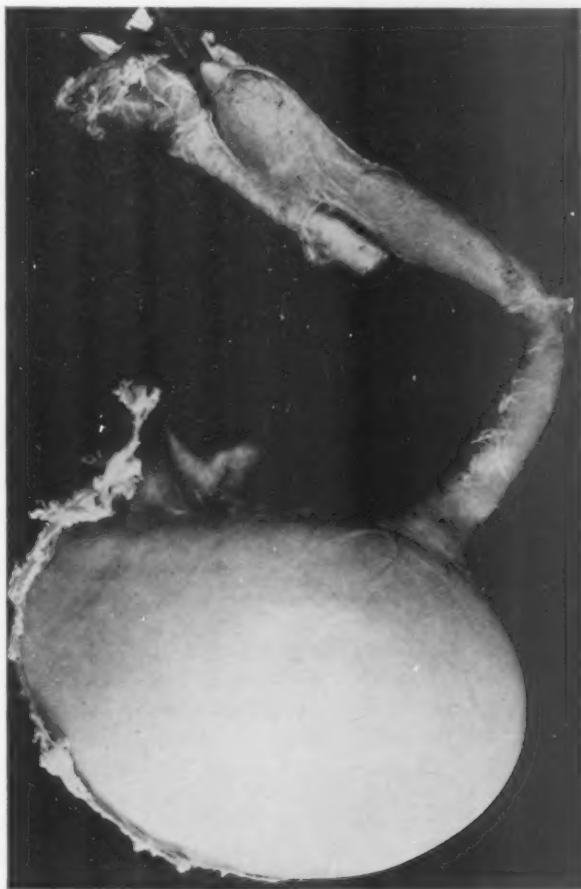


FIG. 11.—Photograph of the stomach and œsophagus of a dog. Killed 7 days after the second operation and filled with water under pressure. Note that leakage does not take place. (Neck resec.)

suture the split in the fascial tube. This suture is begun immediately distal to the forceps which clamps the upper cut end of the œsophagus. Great care is exercised to avoid soiling of the field from the cut end of the œsophagus. The cobbler's suture is continued to the lower forceps, which is now removed. The lower angle of the split in the fascial tube is closed and one stitch beyond is taken. Stitches are placed to close the upper angle of the split in the fascial tube. The forceps is now removed from the œsophagus at this point and these stitches are immediately tightened. A second continuous suture is

now placed so as to bring the loose connective tissue snugly over this suture line of the fascia lata (Fig. 8). The neck is closed without drainage.

November 3, 1920: Dog active. Wound looks good. Drinks milk.

November 5, 1920: Dog can drink, but cannot eat solids.

November 13, 1920: Dog killed.

Autopsy: The œsophagus is adherent to surrounding tissues of the neck. A thickening indicates the site of resection. There is no pus. The entire œsophagus and stomach is removed en masse. The œsophagus does not leak at the site of resection. The lumen is patent. The inside of the œsophagus shows three-quarters cm. of new epithelium from the cut edges. Particles of food and hair are lodged on the connective-tissue tube which replaces the resected œsophagus. There is no mediastinitis or empyema.

Microscopical: The sections taken at the cut edges of the œsophagus and at the edge of the growing epithelium are practically identical with those of figures 6 and 7, respectively.

A. T., 1 (April 1, 1921): Rigid asepsis. With artificial respiration and ether, the left chest is opened between the sixth and seventh ribs. A double sleeve of fascia lata is placed about the œsophagus. One plain catgut is used on all sutures of the fascia excepting for the anchor sutures at the ends of the tubes of fascia lata. The anchor sutures are of interrupted black silk. The chest is closed without drainage.

April 2: Dog active; respiration 48 per minute; temperature, 100.2. Appears to be in little pain.

April 6: Friction rubs heard over chest. Dog eats liquids only.

April 8: Operation II. The left chest is again opened. The costal and visceral pleuræ are firmly adherent throughout the greater part of the left chest. The adhesions are carefully broken up. The black anchor sutures make it easy to distinguish the ends of our fascial tubes. (A bougie passed through the mouth and down the œsophagus is of great service in locating the transplant.) The inner tube of fascia and a portion of the entire circumference of the œsophagus is removed between clamps as in the preceding cervical experiments. Care is exercised to prevent soiling from the cut ends of the œsophagus. Two-twenty catgut for closing the outer tube of fascia. The chest is closed *without* drainage. April 9: Dog listless. Morphia freely. April 10: Milk and water by mouth. April 30: Dog killed.

Autopsy: The left lung is firmly adherent to the costal pleura. The œsophagus is found imbedded in adhesions. These are easily broken up and the œsophagus removed in toto. A No. 16 French catheter can be passed through the reconstructed portion of the œsophagus. Under marked pressure the reconstructed œsophagus does not leak water.

Twenty-two experiments for resection of the entire circumference of the œsophagus were done. Tabulated, see Table II.

There are three considerations of moment in these two series of experiments in which the entire circumference has been resected. The first is the process of repair; the second is the occurrence of stenosis; and the third is the freedom from leakage.

(1) The process of repair in the two-stage operation with the resection of the entire circumference of the lumen is similar to that in the one-stage operation of series "A." There are, however, certain distinct differences.

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In the present series A-O and AT the overgrowth of the epithelium across the defect must take place from the cut ends of the normal mucosa. It does this readily, for a growing matrix of fascia lata and newly formed connective tissue has been established *before* creating the defect in the epithelium. In experiment A-09 this is found to have bridged across four cm. of the entire circumference of the oesophagus within forty-four days. In the two-stage operation the fascia lata transplant cannot become loosened but remains *in situ*.

(2) In all experiments of these two series, A-O and AT, stenosis of the repair was found at autopsy. This invariably had been noted immediately after the first operation. It could not, therefore, have been the result of contraction of the connective tissue about the reconstructed portion; but was due, in part at least, to an insufficient diameter of the original fascia lata tube. In fact, on account of the relatively small size of the fascia lata, the dog does not serve admirably for a reconstruction of the entire circumference of the oesophagus with fascia lata transplants. In those experiments where four or five cm. of oesophagus was resected, it was found necessary to use both fasciæ latæ to form the outer tube. In these, no inner tube of fascia was made. The bougie was not used in any of our experiments, for we were desirous of knowing just how much stenosis might result. In experiment A-09, however, the upper two-thirds of the reconstructed portion was found at autopsy to be widely dilated. This dilatation had been produced by the presence of delayed food. It suggests the possibility of preventing stenosis by dilatation.

(3) Leakage of the contents of the oesophagus both at operation and subsequently is prevented in the two-stage operation. Before the avenues for leakage have been opened, a walling off of this portion of the oesophagus has taken place. Moreover, the tube of fascia lata transplant is already attached by water-proof adhesions to the ends.

Figure 8 is a microphotograph of a section through the end of the outer tube of fascia lata and the cut end of the wall of the oesophagus in experiment A-02. "M" is the muscle wall of the oesophagus, "F" the fascia lata transplant, "L" is the lumen of the oesophagus. Note that there can be no leakage of the contents of the oesophagus.

Figure 9 is an illustration of the technic of removal of the inner fascia lata tube and the section of oesophagus. The oesophagus is excised between the two clamps of each pair. The split in the outer tube of fascia lata is sutured before removal of the clamps a and b, which are crushing the remaining ends of the oesophagus.

The longitudinal slit in the outer tube of fascia lata is sewed together by two twenty-day catgut, using a cobbler's stitch. This is placed as a continuous suture, but it is well to tie the two ends of the suture together at the completion of each second stitch. This suture line is then reënfored by a

TABLE II.

Experiment No.	Days after Oper. No. I.	Days after Oper. No. II.	Died or killed.	Infection after Operation No. I.	Infection after Operation No. II.	Leakage after resection.	Mediastinitis.	Empyema: Double is "++"	Stenosis after Operation No. I.	Stenosis after Operation No. II.	Æsoph. fistula	Adhesions between ends tube and æsophagus.	Remarks
A-01	19	..	K	O	..	..	O	O	++	..	O	+++	
A-02	8	..	K	O	..	..	O	O	++	..	O	+++	
A-03	9	7	K	+	+++	O	O	O	++	+	O	++	
A-04	4	..	D	++++	..	..	+	++	++	..	O	Few	
A-05	10	11	K	O	..	O	O	O	++	+	O	+++	
A-06	9	4	D	O	+	O	+	++	++	+	O	++	Soiling by æsoph. contents at Op. I.
A-07	26	..	D	++++	..	..	+	++	++	..	O	+	
A-08	21	8	K	O	O	O	O	O	+++	++	O	+++	Gastrostomy kills.
A-09	31	44	K	O	O	O	O	O	++	+	O	+++	
A-010	30	4	K	O	O	O	O	O	++	+	+	+++	Fed bones by mistake.
A-011	30	2	K	O	O	O	O	O	++	+	+	+++	Bones by mistake.
A-012	34	1	K	O	O	O	O	O	++	+	+	+++	
A-013	10	..	D	+++	..	..	+	++	++	..	O	+	Mangy poodle.
A-014	6	26	K	O	..	O	O	O	++	+	O	+++	
A-015	4	..	D	+	..	..	+	++	++	..	O	+	
A-016	11	..	D	O	....	..	O	O	++	..	O	++	Autopsy: Abdominal hemorrhage. Cause unknown.
AT-1	7	22	K	O	O	O	O	O	++	+	O	+	
AT-2	3	..	D	+++	....	..	+	+	+	..	..	+
AT-3	10	14	K	O	O	O	O	O	++	+	O	++	
AT-4	9	10	K	O	O	O	O	O	++	+	+	++	
AT-5	12	3	K	O	O	O	O	O	+++	+	O	+	
AT-6	2	2	D	O	++	++	+	+	++	+	O	+	Soiling at Op. II. acct. crushing forceps improperly applied to æsophagus.

layer of the loose connective tissue which surrounds the tube of fascia lata. It is brought to lie snugly over the suture line of the fascia lata transplant.

Figure 10 is a microphotograph of a transverse section of the outer tube of fascia lata in experiment A-012. The experiment was sacrificed at the end of one day. The method for reënforsing the suture line is clearly shown. *A* is the line of suture of the outer tube of fascia; *b* is the line of suture of the loose connective tissue which is brought across and seals the suture line of the fascia lata transplant.

Experiment A-03 illustrates the reliability of the method. Here the wound was infected at the first operation. In the presence of known infection, however, the second operation was done. The dog was fed liquid food on the following day. Endoscopic examination on the third day showed the lumen of the fascial tube to be intact. The dog was killed on the seventh post-operative day on account of the condition of the neck wound.

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The stomach and oesophagus is shown in figure 11. To obtain the distention, the stomach was filled with water through the pylorus. The oesophagus was clamped above the resection. The presence of the distention between the forceps and the reconstructed portion shows that the lumen of the fascial tube is patent. Under marked pressure the repair was found to remain water-tight.

The effectiveness of the two-stage operation in preventing leakage can well be seen by a comparison between the data in this series of experiments A-O and AT, and in those experiments of series A in which the entire circumference of the oesophagus was resected; in series A *all* experiments show spontaneous leakage, in series A-O and AT (two-stage) one shows spontaneous leakage.

To Summarize.—Infection plays a very grave rôle in surgery of the oesophagus. Autoinfection is of great consequence. Aseptic technic should be strictly observed.

The usual operative procedures for reconstruction of the oesophagus are dilatory and tedious, both for the surgeon and for the patient. They require from three to eighteen months for the completion of a serviceable oesophagus; they necessitate a series of separate operations. The post-operative mortality is high. A simpler, speedier and safer procedure for its reconstruction is much to be desired.

Fascia lata transplants possess the welcomed attribute of sterility. Reconstruction of the oesophagus with fascia lata transplants should not be attempted by a one-stage operation because of the danger from leakage of the contents of the oesophagus. By a two-stage operation, however, the fascia is allowed to seal itself to the oesophagus before the lumen of the oesophagus is opened. This prevents leakage and autoinfection.

Early stenosis may or may not result from repair of defects in the wall of the oesophagus by autogenous fascia lata transplants. This stenosis is augmented by early detachment of the fascia lata transplant. Detachment is guarded against by the two-stage operation. Early stenosis necessarily follows the substitution of a fascial tube with a lumen of insufficient diameter. The fascial tube should, therefore, have an equal, or better, a greater diameter than that of the oesophagus. Dilatation with the bougie seems feasible and should be started early after the second operation. In fact, we should strive to prevent the formation of stenosis rather than to try to correct it after it has occurred. The sections and specimens indicate the probability of safety for dilatation at the end of seven days.

CONCLUSIONS

1. It has been shown to be possible to reconstruct portions of the entire circumference of the oesophagus with fascia lata transplants. The result is a tube lined with squamous epithelium derived from the epithelium which normally lines the oesophagus.

2. By the two-stage operation the danger from leakage of the contents of the œsophagus and autoinfection is reduced to a minimum.

NOTE.—This work was begun in 1918, but for various reasons was not completed until 1921. I am indebted to Dr. Ernest Sachs, at whose suggestion the work was begun, and to Dr. A. C. Brooks and Dr. G. K. Dickson for assistance in the experiments.

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EXTIRPATION OF ONE (LEFT) ADRENAL GLAND FOR THE CURE OF EPILEPSY

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UP to the present time the efforts of surgeons to cure epileptic convulsions have been mainly confined to operations on the brain and on the skull, with the very few exceptions in which peripheral irritation by old scars or by some nasal affection was held responsible for the production of the convulsions.

It is not possible for me to enter into a detailed description of the many theories which have been put forth to explain the causes of the malady; suffice it to say, that up to a recent date the seat of the disease by all investigators was thought to lie in the central nervous system, the brain.

Recently Heinrich Fischer¹ advanced a very interesting and new theory which he has substantiated by animal experiments. He found that *by reduction of adrenal substance in the animal body, the tendency to convulsions can be reduced.*

As these investigations give us an entirely new conception of the disease and shows us a new way to attack it, it is necessary for me to embody here the investigations of Fischer.

In the following I shall give an abstract of his publication "Ergebnisse zur Epilepsiefrage" which appeared in the Zeitschrift für die gesamte Neurologie und Psychiatrie, volume 56, 1920, as far as it is necessary.

Our modern conception of the nature of an epileptic attack was formulated at a time when we still believed that the symptom of convulsion constituted the disease itself. Today, it is a well known fact to the clinician that convulsion and "epilepsy" have not the same meaning.

Fischer proposes to substitute for the usual expression "epileptic convulsion" the word "elementary convulsion."

Diseases which are accompanied by elementary convulsions he includes under the heading "convulsive diseases." The most important of these "convulsive diseases" is the "common epilepsy." The increased ability of the animal body to respond with convulsive attacks he calls "Krampfbereitschaft" (readiness of the animal body to react with convulsions to irritation).

In future one ought not to be skeptical towards experimental investigation of convulsive diseases. The objection voiced against this form of investigation was that the experimentally produced convulsions had nothing in common with epileptic disease in man. This objection, of course, holds true. Con-

¹ Heinrich Fischer: Ergebnisse zur Epilepsie Frage. Ztsch. f. d. ges. Neurologie u. Psychiatrie, vol. lvi, 1920.

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vulsion produced by animal experimentation has just as little to do with epilepsy as a convulsion produced experimentally in the human being. However, it seems to him unjustified to draw such a rigid distinction between experimental convulsions based upon traumatism and intoxication in man and the experimentally produced convulsions in mammals. It seems to him possible to attack by experimentation not only the traumatic and toxic, but also the increased constitutional "krampfbereitschaft."

Experimental investigation of convulsive diseases must be regarded as an important step towards the exploration of these diseases.

Redlich and Vogt have laid stress upon the fact that the brain has the ability to react with convulsions to certain pathological stimuli.

Fischer goes a step further and states that this ability is not alone confined to the brain as such, but is a distinct form of individual reaction of the whole organism.

An important part of the convulsive mechanism is centred in the brain, which, however, is not the only point of attack. The effect of peripheral stimuli on the production of convulsive attacks and the quality of peripheral concomitant phenomena leads one to question the cerebral source of this convulsive mechanism.

Convulsions are, as far as we can judge, an expression of excessive labor performed by the striated muscular fibre and the production of convulsions is in turn dependent upon the functional ability of these fibres.

The question arises therefore, whether this excessive response of the muscular fibre to stimuli is entirely dependent upon central influences, or whether peripheral influences also play a rôle.

Numerous experiments have proved that there exists a close functional relation between muscular labor and the adrenals. Animals in which the adrenals have been removed show an increasing muscular weakness as the main symptom. In Addison's disease muscular asthenia is the foremost symptom. In animals without adrenals death is considerably hastened by forced labor.

In normal animals excessive muscular labor produces an increase in the production of adrenalin and during the stage of muscular exhaustion the

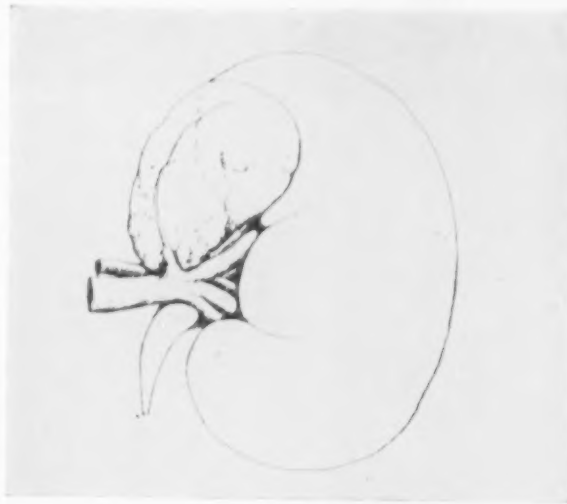


FIG. 1.—After Alberman.

chromaffine system is also exhausted. During recuperation the adrenalin content is increased and again reaches normal values after several hours. Experiments in animals have shown that the administration of adrenalin increases muscular function, which conforms with our experience in man. Langlois found that, as administration of adrenalin in Addison's disease brings the contraction curve of the musculature to normal, the subjective feeling of muscular fatigue also diminishes. In persons who have died after convulsive seizures the adrenalin content of the adrenals was found subnormal. Roessle found in three cases of death during an epileptic attack large adrenals with fatty degeneration and with remarkably little medulla.

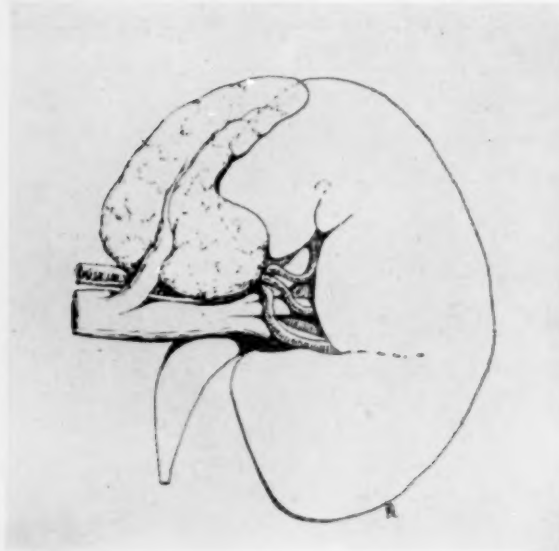


FIG. 2.—After Alberan.

Elliot and Tuckett made the important and interesting observation that the size of the adrenals in general increases with the size of the body and especially with the increase in muscular development in vertebrates. This increase is noticeable especially in the cortex. Guinea-pigs which have a great tendency to convulsive attacks are endowed with especially large adrenals.

This undoubted interrelation between muscular labor and functional activity of the adrenals induced Fischer to under-

take a series of experiments in rabbits in order to determine whether the chromaffine system plays a rôle in the mechanism of convulsions.

These investigations he undertook in 1913 and 1914 (not published as yet) and he thinks he has arrived at definite results.

He could demonstrate that in rabbits the capacity for convulsions decreased with the decrease of adrenal substance. If the substance of the adrenals was reduced considerably the tonic-clonic cramp was substituted by a coarse tremor of the extremities.

After extirpation of both adrenals administration of amyl nitrite did not produce any convulsions *if no accessory adrenals were present* in the body. Unconsciousness which usually accompanies the convulsions did not occur either. The destruction of *adrenal medullary* substance has no important influence upon the convulsive capacity of the animals. This fact of course, does not minimize the undoubted importance of the chromaffine system for

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the production of convulsions. The secretory function of the chromaffine system is dependent upon the presence of *adrenal cortical substance*.

Animals which had been sensitized by electrical irritation of the brain cortex reacted stronger upon administration of amyl nitrite.

This traumatic hypersensitiveness of the brain could be reduced by diminution of the adrenal substance. The animals, however, continued to be more sensitive than the control animals with similar adrenal reduction. After removal of the total *cortical* substance of the adrenals these animals with traumatic cerebral hypersensitization reacted upon inhalation of amyl nitrite with only a few contractions which did not in any way resemble the convulsions of normal animals.

The conclusion could now be drawn that the capacity for convulsions by peripheral stimuli would increase in animals in which it was possible to produce, experimentally, a hyperfunction of the adrenal cortex. In these experiments Fischer made use of the fact that the adrenal cortex appreciably increases in volume in rabbits with chronic alcohol poisoning, and in rabbits which had been castrated.

By these experiments Fischer proved that the capacity of the body to react with convulsions is dependent upon a sufficient amount of functionally active adrenal substance. *The adrenals belong, probably inclusive of the whole chromaffine system in the body, to the convulsive mechanism.* His experiments have also shown that there exists a peripheral component of the cramp-mechanism in the body.

The peripheral component joins with the central component in the musculature by means of the peripheral nerves. On the other hand, there exists a direct continuation between the cerebral sympathetic system and the adrenals by means of the sympathetic nerves. The cortex of the adrenals, as part of the chromaffine system, is directly derived from the sympathetic. A complete cycle of the cramp-mechanism is hereby formed.

The important stations in this cycle are the brain, the adrenal system, and the musculature. The communication of the parts with each other is produced partly by the motor and sensory nerves, partly by the sympathetic, and partly by the blood as a carrier of hormones.

The possibility of a far-reaching interrelation between the peripheral and the central components of the cramp-mechanism is therefore evident. How-

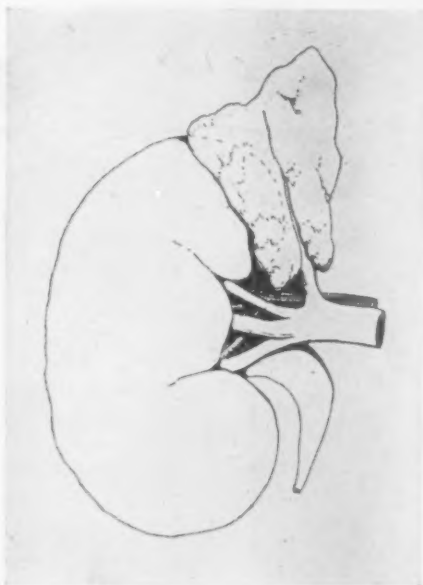


FIG. 3.—After Alberan.

ever, one must not conclude that the patient who suffers from a convulsive disease must have a hypertrophy of the adrenals. A disturbance of function in the sense of a high nervous instability is sufficient to explain the phenomena.

This theory of Fischer's has been taken up by Brüning and put to a practical test in fourteen cases of severe epileptic convulsions, by removing a part or a whole of one adrenal gland. He reports: No mortality. Three cases are still under treatment. Of the other eleven patients five are cured, respectively. In one case attacks are less in intensity and duration but occur more frequently. No result in three patients (age 38, 52, 45) who had their attacks for a long time. It is characteristic of all cases that the attacks cease

immediately after the operation.

If new attacks occur they can usually be suppressed by administration of very small doses of Sedobrol or Luminal 0.05 t.i.d. whereas all these medicaments had no influence at all before the operation.

In January, 1921, the following case of epilepsy of long standing came under my observation. (Kindly referred to me by Dr. Ransohoff.)



FIG. 4.—After Alberan.

W. G., twenty-five years old, has been suffering from epileptic attacks for sixteen years. His family history is negative as far as nervous diseases are concerned, with the exception of an uncle of his mother, who died of "softening of the brain." The beginning of his disease dates back to early childhood when he was subject to frequent attacks of convulsions. When seven years old he was hit by a trolley-car and pushed several feet; he did not sustain any injuries but was very much terrified by the accident. After this psychic trauma he began to have epileptic attacks more frequently and more severe. Slowly the disease progressed in spite of long treatment, medical as well as surgical. He now has ten to fifteen attacks every night; his psychical condition is deplorable. He had scarlet fever, whooping cough, measles and mumps. At seven years of age he had chorea which lasted one year.

Up to 1914 his attacks were of the type of epileptiform equivalents and petit mal; after that he had typical attacks of grand mal.

In 1910 circumcision, and in 1915 a subtemporal decompression on either side was done without giving any relief.

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In 1918, following a series of attacks, patient hallucinated for several days. Attacks are more frequent at night. Complains of frontal headaches and occasional attacks of temporary blindness after attacks.

Physical Examination.—Well-built, well-developed young man of twenty-five, slow in coördination of speech and movements, rather expressionless face.

Head: Well developed, hair well distributed, scars of two operations for temporal decompression. Scar on forehead.

Eyes: Pupils react equally to light and accommodation, vessels normal, muscles normal, optic disc normal, a little pale on temporal side.

Throat: Small tonsils, slightly injected pharynx and tonsils.

Teeth and Gums: In excellent condition.

Chest: Well developed, of equal expansion.

Lungs: Resonant throughout and clear.

Heart: Sounds of good quality, not enlarged, no murmurs.

Abdomen: Normal.

Extremities: Normal.

Reflexes: Knee-jerks exaggerated.

Genitals: Normal.

Wassermann: Negative.

Urine: Reaction, acid; specific gravity, 1022; sugar, negative; albumin, negative.

Chemical Blood: Urea (12-15), 11.0; creatinine (0.5-2), 0.45; uric acid (1-2.5), 2.0; sugar, per cent. (0.08-1.2), .07.

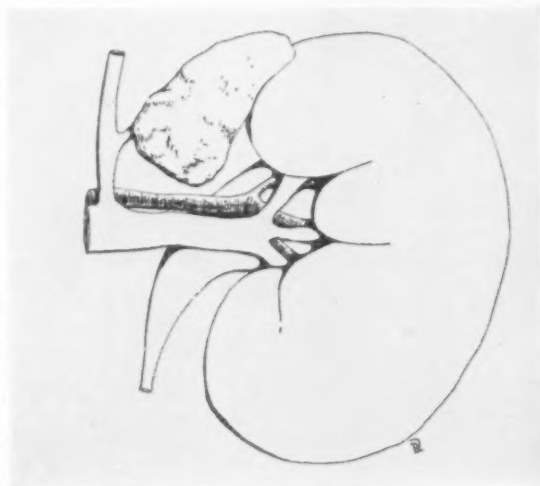


FIG. 5.—After Alberan.

Sugar Tolerance Test: Ingestion of 100 grams glucose. Before glucose, .102 per cent.; urine, negative; forty-five minutes after, .108 per cent.; urine negative; two hours after, .093 per cent.; urine negative.

Typical Attack: 1. Patient becomes rather quiet and usually, when a long series of attacks are to follow, patient sits quietly for days; then becomes cyanotic, sometimes has hacking cough just before attack.

2. Patient falls, becomes stiff and then has clonic contractions, at times froths at the mouth and bites tongue; this stage lasts one-half to one minute.

3. Patient then becomes restless and moves about in bed for a variable period of time (five minutes to several hours). When attacks are very severe patient usually screams and moans for hours.

Endocrine Examination.—(Doctor Blumgarten.) The patient is a rather dull, lethargic blond young man, slow and deliberate in his movements and in speech. The skin is markedly pigmented, especially around the lower abdomen, acne on back. There is a moderate growth of hair over lower abdomen, legs, thighs and buttocks. There is no Sergeant's line. There is a marked generalized adiposity. The head shows evidence of previous trephining operations. The forehead is prominent and broad. The lobes of the ear are attached to the side. The nose is normal, not unusually broad. The lips are thick and prominent. The teeth are in excellent condition, there is no increased interdental spacing, but the lower set comes directly in apposition with the upper.

The neck is short and stocky, the thyroid is not enlarged. Chest is broad, the costal angle is wide, the breasts are well developed. The extremities are normal, the hands are rather delicate, the fingers are long and pointed. No tremor, no cyanosis.

Span, 65½ inches; height, 5 feet ¾ inches; weight, 162 pounds; sterno-clavicular junction to malleolus, 52 inches; anterior superior spine to malleolus, 38 inches; upper extremities, 26 inches; torso (length), 7½ inches; pelvic width, 13 inches.

Sugar tolerance, slightly diminished; blood chemistry, slightly low sugar; pilocarpine test, negative; Goetsch test, moderately positive; blood-pressure—systolic, 85; diastolic, 55.

Conclusion: The patient is a pituitro-adrenal type.

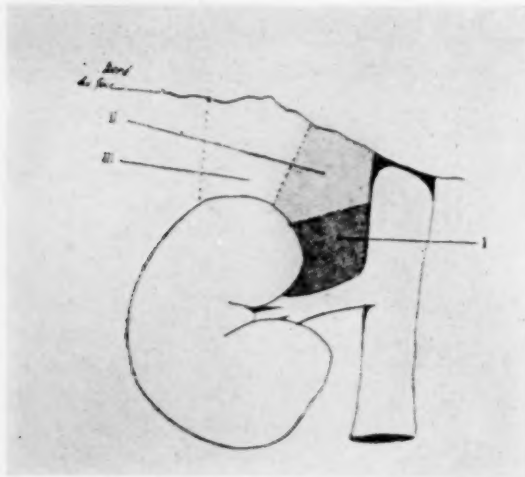


FIG. 6.—After Alberan. 1. Low situation, more frequent, especially on left side. 2. High situation, only on right side. 3. Very rare.

into the wound and by tearing the loose areolar tissue between the diaphragm and the upper pole of the kidney capsule. By this manoeuvre the kidney could easily be pushed down far enough to expose the upper pole of the fat capsule. The perirenal fat capsule was now carefully separated with blunt forceps until the flat, greenish-gray adrenal gland was seen resting on the top of the kidney. The organ was now carefully separated from the upper pole of the kidney by blunt dissection, a small arterial branch coming down from the diaphragm was torn, the main artery and two small veins coming from the renal artery and vein, respectively, had to be tied. One has to exercise some care in dissecting the median aspect of the gland, as it lies in close contact with the renal vein. The organ was removed in toto without tearing. There was no bleeding of any account. A cigarette drain was put in the bed of the removed organ and led out through the wound; wound closed down to drain. The operation lasted one hour thirty-five minutes.

The pulse after operation went up to 140 but soon came down to 90-100.

Blood-pressure, which was 85/55 before operation, jumped up to 100/65.

On the third day post-operative blood-pressure was 115/65. Patient in good condition, mentally much brighter. Wound is draining rather profusely.

His convalescence was smooth. Two weeks after operation patient felt very well. He was much brighter and in the last days more alert, took an interest in his surroundings, read the paper and even wrote a postal card to his relatives, which

As all attempts at a cure have been futile in this case and as the condition of the patient became worse and more deplorable every day, it was deemed justified to give this new operation a trial.

Operation.—February 12, 1921. *Extirpation of Left Adrenal Gland.* Typical lumbar incision (Bergmann-Israel) as in operation for nephrectomy with resection of twelfth rib.

After exposure of the fat capsule of the kidney, the kidney, together with its perirenal fat capsule, was dislocated downward by introducing one hand

EXTIRPATION OF ADRENAL GLAND FOR EPILEPSY

he had not done for years. Has had no convulsion since operation. (On admission to the hospital he had a very severe convulsion on January 31st and February 2nd; another on February 5th; then one slight convulsion on February 11th. In the night of February 12th, just before operation, three severe convulsions.)

Pathological Report.—(By Doctor Rohdenberg.) Gross Appearance: Specimen consists of an adrenal gland measuring about 3 x 4 cm. and varying from 2 to 4 mm. in thickness. It is light brown in color and the surface shows a few adhesions. There is no evidence of inflammation.

Microscopical examination shows an adrenal gland in which the relative proportion between the cortex and the medulla is disturbed, the medulla being distinctly smaller than usual. The cells of the cortex at the periphery of the gland are markedly vacuolated. About the centre of the cortex the cells are apparently filled with the products of secretion, while in those adjacent to the medulla there is again an area of vacuolization. The medulla itself shows no histological abnormalities. Special lipid stains show a maximum of deposit in a zone two or three layers of cells beneath the capsule and about the central vein. The medulla is practically free of lipid deposit.

Special stain for connective tissue fails to demonstrate abnormality.

By staining the sections in acid fuchsin, followed by Mallory's aniline blue and Soudan 3, there are evident in the zones of the maximum lipoidal content very small, almost black intracellular granules varying from 1 to 25 or 30 to the cell. These granules are scattered at the periphery of the cell and are not in direct relation to the nucleus. The significance of these granules is not known. They do not occur in all parts of the section. Mitochondria are not demonstrable.

March 3: Out of bed, feels very good. March 4-5 (19 days after post-operative): Patient had five convulsions during the night; each convulsion lasted from one-half to one minute. Bit tongue, became cyanosed and moved hands and feet considerably. March 5: Convulsion at 9.45 A.M., lasting one-half minute; pulse very rapid, pupils dilated. March 6: Had one convulsion. March 7: Had two convulsions. March 9: Had five convulsions, bit lip and tongue. March 10: Five convulsions lasting two to four minutes. March 11: Five convulsions, each one appears to be a little more severe. March 12: Had six convulsions, very bad. March 13: Very noisy, refuses to eat. Seven convulsions; first very light,



FIG. 7.—After Alberan.

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last two very severe. March 14: Had three convulsions—not severe. Refuses nourishment. March 15: Two light convulsions; takes nourishment well. March 16: Had five very light convulsions between 8.20 and 11.25 P.M. March 17: Had convulsions at 8.40, 9.25, 10, 10.45, 11.25 P.M. March 19: Has not had convulsion for two days. To-day at 8.35, 9.30, 9.35, 10.05, 10.35, 11.10, 1 A.M. March 20: Very light convulsion. March 21: 9.05 P.M. slight convulsion—twitching of muscles of arms and legs, no loss of consciousness. March 22: Convulsion at 8.30 P.M.; very slight. March 24: Convulsion at 8.30, 11.30. March 26: Convulsion at 11.30, twitching of arms and legs and patient screaming. April 10: Has not had any convulsions since March 26th. Discharged from hospital. April 20: Had convulsions lasting four minutes at 8 A.M. Slight twitching of muscles. At 9.15 P.M. slight attack. At 11 P.M. slight convulsion, contraction of abdominal mus-

cles. Brother says the attacks are nothing compared to his attacks before the operation. May 7: Brother reports patient is perfectly well. No convulsions. May 15: 2 A.M. attack of labored breathing with a little frothing at the mouth. Duration three minutes. No loss of consciousness. May 17: 11 P.M., similar attack. May 24: Slight twitching of muscles of neck and head drawn to one side. June 7: Three convulsions, light, bites tongue.

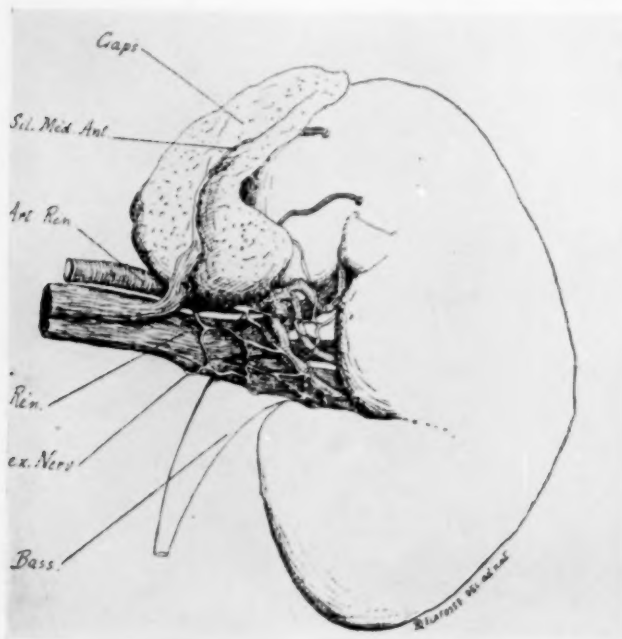


FIG. 8.—After Alberan.

June 8: One convulsion, light. June 18: Three convulsions, light. June 20: One convulsion, hard, in afternoon. July 4: One convulsion, hard. July 16: Five convulsions, light. July 18: One convulsion, hard. August 4: Three convulsions, light. August 17: One convulsion, light. August 19: One convulsion, light, in afternoon, wet bed. August 20: Five convulsions, light, wets bed. August 31: Six convulsions, light, wets bed. September 1: Five convulsions, light, wets bed. September 2: Two convulsions, light, wets bed. September 3: Four convulsions, light, wets bed. September 5: Six convulsions, light, wets bed. September 6: Three convulsions, light. September 7: Five convulsions, light. September 8: One convulsion, light. October 28: Feels very good now, no more convulsions since September 8, 1921.

Before the operation this patient had ten to fifteen epileptic attacks every night. The convulsions were so severe that his three brothers had to hold him down to prevent him from falling out of bed.

Although the patient has not been entirely cured, there is noticeable, however, a distinct improvement. The attacks which he had before the operation are now

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less in frequency and in intensity. He has intervals of complete freedom from convulsions (March 26 to April 20; September 8 to October 28).

Surgical Anatomy of the Adrenal Gland.—The anatomy of the adrenal gland is usually treated rather superficially by the standard text-books of Anatomy.

A very exhaustive study of the anatomy of the organ has been made by J. Alberran and Cathelin.²

Situation.—It is very rare to find the adrenal gland lying on the top of the upper pole of the kidney as is usually supposed. The adjective "suprarenal" gives, indeed, a wrong impression of the situation of the organ. "Adrenal gland" is the more appropriate term.

In the majority of cases in the human being as well as in all other mammals, the adrenals are placed along the inner border of the kidney, above its pedicle, near the spinal column. On the right side the organ is in close proximity to the vena cava and on the left side it lies close to the aorta. The upper extremity of the gland seldom passes beyond the upper pole of the kidney. (Figs. 1, 2, 3, 4, 5.)

One can distinguish two variations in the situation of the adrenal gland: (a) the low situation, which is very frequent; (b) the high situation, which is encountered only on the right side, where the organ is lodged deeply in the angle of the vena cava and the liver (Fig. 6).

There are always two adrenal glands present, one on either side. The few reports in the anatomical literature of total absence of the adrenal glands must be considered with caution, as for instance the observation of Schet who found the adrenal replaced by an abundant mass of fat.

In some rare cases (Rokitansky, Grawitz, Weiler, Ulrich) the adrenals were found lying beneath the capsula propria of the kidney.

Accessory adrenal glands are frequently found on the cadaver, especially in children. These accessory adrenals can have a real importance in medical pathology, Roth having found multiple adrenals in the state of compensatory hypertrophy in a case of Addison's disease. In the surgery of the kidney, accessory adrenals have become of quite some importance since Grawitz discovered that they are frequently the starting point of large pararenal tumors, the so-called hypernephroma.

These accessory adrenal glands are found: (1) below the capsula propria of the kidney, or even in the parenchyma of the kidney itself; (2) in the neighborhood of the adrenals; (3) along the spermatic vessels; (4) within the solar plexus; (5) on the surface of the ovary; (6) in the substance of the testicle. Wherever they are situated, these accessory adrenal bodies are very small, rarely

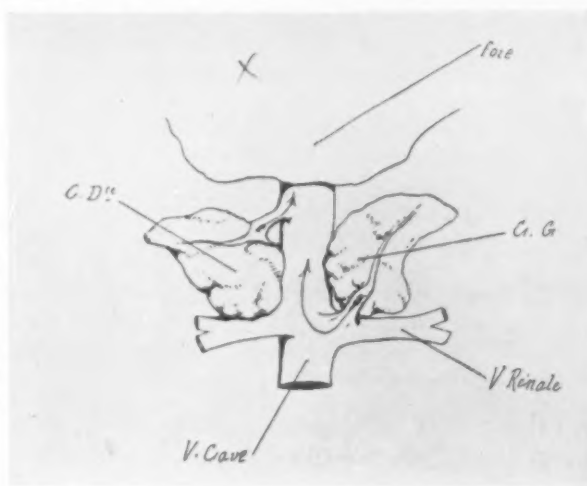


FIG. 9.—After Alberan.

² Revue de Gynecologie et de Chirurgie abdominale, vol. v, 1901, p. 973.

larger than 7-8 millimetres in the largest diameter. They are little, round, and egg-shaped bodies of yellowish color and of soft consistency. Sometimes they are surrounded by a thin capsule which separates them from the surrounding tissues. Only rarely, and then only in the large ones, a reddish portion represents the medullary substance.

Otto describes a case in which both adrenals had been fused together in the form of one organ.

Regeneration of the adrenal glands was first described by Tizzoni and has been observed also by others, although Langlois doubts the possibility of regeneration. However, all observers concur that compensatory hypertrophy does occur on the not-operated side.

The color of the glands varies from a yellowish to a grayish color. In two cases Alberran and Cathelin found them to be light red. Frequently one encounters small yellowish spots of the size of a pin-head, sprinkled over the surface of the organ. These little granules are simple adenomata.

The parenchyma of the gland is usually soft and friable; attempts to sever its connection with the surrounding tissues, if not done very carefully, result in tearing. In the cadaver it feels a little harder and on palpation gives the impression of a lobulated gland.

The right suprarenal capsule is usually a little larger than the left; on the average the organ measures 5 cm. in length by 2 cm. in width. The average weight is 4 grammes with a maximum of 2 grammes.

The form of the adrenal gland is usually given as that of a Phrygian cap. This, however, is only true in the case of the fetal organ. In the adult its form varies greatly. It may be triangular equilateral, elliptical, ovoidal or crescent-shaped. On the whole one can say that its form resembles a large comma, placed in such a fashion that its head points toward the pedicle of the kidney. Very often the two organs vary in shape in the same individual. On one side the gland is triangular and ovoid on the other. One organ may be also smaller than the other one.

Blood Supply.—On the anterior surface of the gland one usually finds a small furrow running vertically downward and carrying a large vein. This furrow is often called the hilus of the gland, although it cannot be compared to the hilus of the liver or the kidney, because the main vessels of the gland do not enter here. The adrenal gland has three vascular pedicles corresponding to three arteries.

The superior adrenal artery arises from the superior diaphragmatic artery, the middle adrenal artery from the abdominal aorta, the inferior adrenal artery from the renal artery. This vascular arrangement is subject to slight variations, at least in regard to the two branches. Very often there exists a common trunk, arising from the inferior diaphragmatic artery and giving off two smaller branches, an internal and an external branch.

The middle artery may be missing. On the right side it passes beneath the vena cava and over the right crus of the diaphragm. G. Martin has seen a case in which a large artery coming from the aorta, between the coeliac axis and the superior mesenteric artery, sent two branches to the left kidney and two small ones to the suprarenal capsule.

The inferior artery is often replaced by a branch arising from the renal parenchyma from the superior internal pole (Fig. 7).

By their anastomosis there results a peri-suprarenal arterial network which surrounds the gland.

Veins.—There exists one principal vein (central vein of Testut; middle capsular vein or suprarenal vein of Charpy). This is the collecting trunk which carries the larger part of the venous blood of the gland. Its average length is

EXTIRPATION OF ADRENAL GLAND FOR EPILEPSY

3 millimetres. On the left it emerges from the inferior third of the anterior surface of the gland and on the right side near its internal border. It runs in a small furrow of the gland and is fastened to the organ by thin connective-tissue bands (Fig. 8).

After leaving the gland the left vein takes an oblique direction downward and towards the right to empty itself into the renal vein; the right vein turns upward and to the left to join the vena cava (Fig. 9).

Lymphatics.—They were studied by Stilling and Sappey. Stilling in 1887 injected them and thought them to be the excretory ducts of the gland. Sappey found a large lymph-node situated above the renal vein. This lymph-node receives three suprarenal lymph-vessels which communicate with another lymph-node, which also receives lymph from the kidney.

Nerves.—The nerve supply of the adrenal glands is very abundant. It forms a rich network derived from the solar and renal sympathetic plexuses. It may be possible that the pneumogastric and phrenic nerves contribute to the nerve supply.

TECHNIC OF OPERATION FOR REMOVAL OF LEFT ADRENAL GLAND

According to its anatomical situation the left adrenal has been selected by all surgeons who have done this operation. The main reason for this is the better accessibility on this side. On the right side, as stated before, the adrenal is well tucked away in a niche formed by the liver and the vena cava. Although there is unanimity on this point, surgeons differ as to the best approach. Two ways have been selected: the transperitoneal abdominal method and the extraperitoneal lumbar incision.

Brüning has used the transperitoneal route. He uses an incision somewhat S-shaped. Incision in median line from ensiform process 10 cm. downward; from here the incision curves outward, cutting transversely through the right rectus; from the outer border of the rectus muscle it turns downward for a few cm. following the direction of the fibres of the obliquus externus.

The peritoneum is opened and omentum and intestines pushed aside and held out of the way by abdominal sponges. The stomach must be pushed upward and to the right, the colon transversum downward and secured in this position by the hands of assistants. Now the tail of the pancreas can be seen through the layers of peritoneum. Just a little above the tail of the pancreas the splenic vessels can be identified running towards the hilus of the spleen.

Below the pancreas the peritoneum is incised. Hereby the splenic flexure of the colon is made movable and can be pushed downward. The pancreas is held out of the way above by blunt retractors and in order to do this sufficiently it must be properly isolated up close to the kidney. By this manœuvre a retroperitoneal space is made visible bounded mesially by the aorta, laterally by the upper pole of the kidney, below by the pedicle of the kidney. This space is occupied by the adrenal gland. The organ is covered by a sort of a fascia which is formed by solid fat tissue. Here are also found the arteries, the most important of which is a branch arising from the aorta. These should be tied. The small diaphragmatic branches need no ligature. After ligating the vessels the organ can be removed by careful dissection

with forceps and scissors. After removal of the adrenal gland its fat capsule is closed by a few catgut stitches and the posterior layer of the peritoneum is sewed up.

Brüning advises to use long-handled instruments on account of the great depth of the operating field, *but even then the operation is very difficult.*

Shortly after Brüning's publication, Bumke and Küttner advocated the lumbar approach with resection of twelfth rib. The incision is practically the same as used for extirpation of the kidney (Bergmann-Israel incision).

In my experience the operation has proved to be simple, not any more difficult than an uncomplicated nephrectomy. It has great advantages over the transperitoneal route which is very difficult and complicated. In the transperitoneal route of Brüning, if drainage is necessary, we have to drain through the general peritoneal cavity. This alone complicates matters materially.

In my opinion the lumbar route is the procedure of choice in removal of the adrenal gland.

CASE REPORTS

Brüning: Ztbl. f. Ch. No. 43, 1920, p. 1314. E. S., nine years old. Daily many attacks of amnesia, no convulsions.

Operation, May 4, 1920. Immediate disappearance of attacks of amnesia. These, however, recurred after some time, although less frequently. In this case only one-half of the left adrenal had been removed.

H. Sp., age twenty-one years. Several attacks of convulsions daily.

Operation, April 11, 1920. *Since that time no more convulsions.*

H. M., age eighteen years. Daily convulsions.

Operation, June 18, 1920. *No attack since operation.*

H. S., age thirty-eight years. Several attacks of convulsions and amnesia daily.

Operation, July 12, 1920. The attacks of amnesia have recurred, also had one convulsion. Formerly all internal medication had been futile, now Sedobrol and small doses of Luminal 0.1 two, three times a week suffice to suppress attacks.

M. B., age seventeen years. Severe epilepsy, patient somewhat idiotic. In spite of daily administration of Luminal, ten attacks of convulsions a day.

Operation, July 2, 1920. Since the operation off and on short attacks without loss of consciousness, which can be entirely suppressed by Sedobrol.

H. B., age thirteen years. Old encephalitis with several foci, convulsions with frequent attacks of amnesia.

Operation, July 20, 1920. Attacks after operation less frequent and less intense; can be easily influenced by administration of Sedobrol.

C. F., age fifty-two years. At intervals of four to five weeks attacks of convulsions during several days.

Operation, July 21, 1920. No attack since operation. Time since operation not long enough to judge result.

F. H., age seventeen years. Several attacks daily with attacks of amnesia.

Operation, July 22, 1920. Convulsions have ceased, attacks of amnesia still present.

J. N., age sixteen years. Several attacks of convulsions with attacks of amnesia. Internal medical treatment without success.

EXTIRPATION OF ADRENAL GLAND FOR EPILEPSY

Operation, July 26, 1920. After operation, short, fleeting convulsions without loss of consciousness, easily suppressed by Sedobrol administration.

Brüning used in all cases his transperitoneal route.

Peiper reports that in Schneiden's Klinik in Frankfurt seven cases were operated upon. In every case the immediate effect of the operation was most striking. All the cases were free from convulsions after the operation. However, this happy state of affairs did not last very long; sometimes after a longer and sometimes after a shorter interval the convulsions reappeared in their old severity. Therefore the operation has been discarded in the Frankfurt Klinik.

C. Steinthal operated upon 7 cases—5 male and 2 female. The male patients were 15, 16, 17, 18 and 23, respectively, and the female patients 19 and 29. In one male patient the convulsions started one and one-half years after a head trauma; all the others were cases of genuine epilepsy. All patients were severe epileptics who had undergone careful institutional treatment for a long time without benefit. Method of operation: Lumbar retroperitoneal route. In none of the cases was a complete cure effected.

W. L., age eighteen years. Epileptic since age of four months. In 1920, 101 attacks of convulsion, 30 attacks of dizziness in 1921; three to four attacks a day.

Operation, February 10, 1921. On the ninth and sixteenth days after operation fifteenth day post-operative, then a few slight attacks. March 10, 1921, three attacks.

Discharged March 19, 1921. Adrenal was removed in several pieces; it is possible that a small amount was left.

F. F., age seventeen years. Epileptic since one and one-half years, one year after head injury.

Operation, February 10, 1921. On the ninth and sixteenth days after operation at night, slight clonic contractions without loss of consciousness. March 3, 1921, typical, not very severe nocturnal attack.

Discharged March 10th in good condition.

Lu. L., age fifteen years. Epileptic since one and one-half years without external cause.

Operation, February 14, 1921. After operation no more attacks, but receives regular doses of Luminal. After the removal of the adrenal, severe venous hemorrhage in consequence of slipping of a ligature. In the attempt to control the bleeding the renal vein was injured and had to be tied. Kidney became necrotic, had to be removed subsequently.

M. H., age nineteen years. Epileptic for fifteen years. Rarely a day passes without attacks. Mostly attacks of dizziness. January, 1921, two attacks of convulsions and sixty-eight attacks of dizziness.

Operation, February 21, 1921. The next day after operation two attacks of convulsions, in the course of convalescence twenty-seven attacks of convulsions and seven attacks of dizziness.

F. O., age twenty-nine years. Attacks since eight years. From August, 1920, to February 15, 1921, sixty-six convulsions. And 130 attacks of dizziness.

Operation: February 23, 1921. On the 2nd day and 5th day after operation one attack of dizziness, since operation 11 spells of dizziness and one attack of convulsions. Discharged on March 19, 1921, in good general condition.

A. G., age sixteen years. Epileptic for four years. In 1920, fifty-eight attacks. In January, 1921, four spells, first half of February nine convulsions and four spells of dizziness.

HERMANN FISCHER

Operation, February 21, 1921. No more attacks after operation during his stay in the hospital. Discharged March 10, 1921. As soon as he came back to the Home for Epileptics he had one attack.

A. W., age twenty-three years. Epileptic since his seventh year. Attacks occur at nights. January, 1921, four convulsions and one dizzy spell. Beginning of February, 1921, eight convulsions and one dizzy spell.

Operation, March 3, 1921. Eleven days after operation the first attack of convulsions, which was repeated on the twelfth and thirteenth days.

From these operative results Steinthal concludes that extirpation of the adrenal cannot be considered a cure of epilepsy.

Sandor, St. Four cases of very severe type. After twelve days—four weeks no recurrence of attacks in all four cases. Time of observation too short to draw conclusions.

Seiffert reports one case of idiopathic epilepsy in which he removed the left adrenal capsule according to Brünig's method. Girl, twenty-two years old, since her sixteenth year, epileptic convulsions with each menstrual period. In contradistinction to the other cases thus far operated upon for this condition, a pathologically altered gland was found. It was the seat of cyst of the size of a hen's egg. The fluid of the cyst was of the color of red lacquer. After operation no feeling of numbness and feeling of oppression in head, epileptic attacks shorter in duration, less in frequency. Twice menses without convulsions.

THE SURGICAL VALUE OF THE ESTIMATION OF THE BILE PIGMENTATION (ICTERUS INDEX) OF THE BLOOD SERUM*

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THE need has long been felt for a simple and practical method of estimating accurately the actual degree of icterus existing at a given time. That this could best be done by studies of the blood was a most obvious conclusion. If such a method of blood examination—one that could readily be applied as a routine in the ordinary laboratory—could be found, it would surely prove to be a clinical procedure of considerable usefulness. Very often in early cases of suspected biliary or hepatic disease there is doubt as to whether or not an actual jaundice is present, and the questionable adjective, "subicteric," has been adopted to describe such cases. This term is frequently improperly used and a patient is credited with showing an incipient jaundice when his normal complexion, some other pigmentation, Addison's disease, or merely an anæmic sallowness is responsible for the hue of his skin or sclera. In these cases the usual bile tests for the urine are equally inconclusive. In marked jaundice the inspection of the skin and sclera from day to day, or even from week to week, gives very little information as to its intensity or whether there is a progression or recession of the icterus. One's opinion as to the existence of jaundice in doubtful cases and as to its depth or lightness in advanced cases is greatly influenced by the character of the illumination, and the question of variation from time to time hinges entirely upon the rather uncertain equation of the observer's memory of his retinal impressions. In outspoken icterus the examination of the urine, which, in addition, may vary in concentration, gives very little more assistance in solving these questions.

It appeared, further, that it might be of interest to verify the claim that has been made that the blood showed changes in the bile content, as represented by its pigment, bilirubin, actually before these could be observed elsewhere. It is well known that in certain forms of pernicious anæmia, namely in so-called hæmolytic or acholuric jaundice, a bile discoloration of the skin and sclera appears without bilirubinuria. In these cases bilirubin is found in the blood, seemingly fixed in the plasma. It has also been stated that, in general, bilirubin is only excreted in the urine after a certain point of concentration has been reached in the blood. It has further been asserted that bilirubin may be demonstrated in the blood not only before it is excreted in the urine, but even before it has pigmented the skin or sclera.

Although the surgical literature is strangely devoid of any reference to the subject, the idea of measuring the bilirubin content of the blood is not entirely new. Several attempts have previously been made without, however, much

* Read before the New York Surgical Society, April 26, 1922.

practical result. In 1903 Gilbert, Herscher and Posternak reported on a method of measuring the bilirubin in the serum by an adaptation of the Gmelin-Hayem reaction. Their method is a very complicated, inexact and impracticable one and apparently has never been generally adopted, although it has been modified and used by Scheel and Sunde. Posselt, in 1907, advocating the inspection of the serum in capillary tubes for bile staining as an aid to the early diagnosis of icterus, suggested a comparison of these tubes with a test solution of bilirubin in artificial serum in tubes of equal character as a means of estimating the degree of bilirubinæmia. He gave no data and apparently did not put his suggestion to a practical test. In 1913 Hymans van der Bergh and his co-workers described a method based upon Pröscher's reaction on bilirubin with Ehrlich's diazo reagent, the reaction on the serum being compared to the reaction on known bilirubin solutions. This method is the one that has been most popular and has been advocated by Feigl and Querner, Botzian and others, but most recently and enthusiastically by Lepehne. The method is indirect, quite involved and protracted, has many possible inaccuracies and does not lend itself well to routine laboratory use. Hooper and Whipple, in 1916, described a colorimetric method of determining the amount of bilirubin in the blood in which they tested the bluish-green, acidified bilirubin serum against a standard wedge containing a standardized copper sulphate mixture. This method is in reality a modification of the Hammarsten reaction and does not seem to have found favor. In the same year Hoover and Blankenhorn, in a study of "dissociated jaundice," used Gmelin's test for qualitative examination, but discarded it as not sufficiently delicate for a quantitative estimation of the bilirubinæmia. They accept the principle that the color of the serum is the best guide for this purpose, but used only the very crude method of calculating the proportion of plasma required to give a visible tinge to a 1 cm. column of water.

Inasmuch as none of these previously attempted quantitative methods had proved entirely satisfactory, nor had any been put to general practical use, I took up the matter with our chemist at the Lenox Hill Hospital, Dr. Adolph Bernhard, suggesting preferably a direct colorimetric examination of the blood. Acting upon this suggestion, Doctor Bernhard and Dr. A. Peter Maue began working on the problem. In the meanwhile Meulengracht, of Copenhagen, reported on a direct colorimetric method of testing the color of 1 c.c. of plasma of citrated blood against a standard yellow color, using a 1 to 10,000 solution of potassium bichromate as the approximate normal shade and depth for the purpose. This was done in test-tubes of equal diameter, and the number of times the plasma required dilution with normal saline until it corresponded to the standard color was the figure giving the degree of icterus. He subsequently improved his method by utilizing an apparatus resembling the Sahli hæmoglobinometer. Meulengracht's method is based upon the assumption that bilirubin is practically the only yellow pigment appearing in the blood in appreciable quantities and that any other yellow pigment that may occur in the blood does so in negligible traces. Practically

the only exception to this premise is the occasional occurrence of a lipochrome pigment similar to the lutēin or carotin present in the blood of cows, etc., and derived from their food. This extraneous pigmentation of the blood in the human is supposed to follow a diet of certain vegetable foods, such as carrots, and is therefore said to be found especially in diabetics. Although this point has not been definitely proven, it does seem to constitute an element of error, which, however, can be taken into consideration and which under ordinary nutritional conditions plays no rôle.

Bernhard and Maue found that better results could be obtained by using the blood serum instead of the plasma and further modified Meulengracht's method by using a Duboscq colorimeter, which gave much more accurate and definite results. Their method seems to present the least possibility of error and has the further advantage of extreme simplicity. The centrifuged serum from 5 to 10 c.c. of blood is used. The standard 1 to 10,000 potassium bichromate solution is set at 15 or 20 mm. in the colorimeter and the icterus index is obtained by dividing the reading of the standard by the reading of the unknown serum. Should the color of the serum be too intense to compare with the standard solution, it is diluted with normal saline until its color is nearer that of the standard. When a dilution is made, the resultant figure from the division of the reading of the standard by the reading of the unknown must be multiplied by the dilution figure to obtain the index.

A large number of apparently non-jaundiced, apparently jaundiced and of definitely jaundiced patients have been examined. In 161 individuals without clinical evidence of icterus the figures have ranged from 1.6 in a case of fractured skull (male, age forty-two, No. 4183-'21) to 13.5 in a case of subacute cholecystitis without jaundice (female, age twenty-two, No. 1970-'22). In 144 cases the readings varied between 2.5 and 5, with 3.6 established as the average normal value. These figures probably represent a normal bilirubinæmia which is more or less generally conceded to exist. No case with clinically recognizable icterus went below 14, so that approximately 8 to 14 would be threshold figures. The lowest actual figure with definite though slight icterus was 14.4 in a patient (male, age forty-two, No. P. 1401-'22) with a mild post-operative jaundice after appendectomy and from this point the figures have risen to 210 in a case of extreme icterus (male, age forty-seven, No. 7368-'21). It must be understood that these figures do not represent the actual quantity of bilirubin in the blood, but merely the intensity of the staining of the serum as compared to the color of an arbitrary standard.

As to the practical surgical application of the test, this may be divided into the following headings:

1. *In Differential Diagnosis.* A. *In Suspected Icterus.* The test will eliminate as icteric other discolorations that suggest icterus, as, for example:

Male, age forty (No. P. 828-'22), had been operated on two days previously for an acute gangrenous appendicitis and was seen for the first time in good daylight. His skin and sclera had a distinct so-called subicteric hue and a post-

operative jaundice was suspected. Although the patient assured me that this was his normal complexion, I had his blood tested. The index of 5 showed that the patient's opinion was correct.

In a case of pernicious anaemia (male, age forty-nine, No. 3656-'21) in which the patient had a distinct yellowish hue, suggestive of icterus, the icterus index was well within normal limits (3.5) although another patient with this disease (female, age fifty-five, No. 3757-'21), also distinctly icteric in appearance but with no bile in the urine, had an index of 12. Two other patients with pernicious anaemia (female, age fifty-two, No. 1271-'22 and female, age forty-seven, No. 1942-'22), both subicteric, had icterus indices a trifle above normal, namely, 7.5 and 7.8 respectively. Neither case showed bile or urobilin in the urine.

One of the medical services at the hospital is trying out acroflavine, administered intravenously, in the treatment of various forms of infection. Some of the patients who have received this dye simulate icterus after twenty-four hours. At first it was not quite certain that they were not icteric, but numerous index determinations helped to eliminate the doubt, as the dye apparently only stains the tissues, does not remain in the blood except for a very brief period after the injection, and consequently has no influence on the icterus index after a few hours have elapsed. The following examples will demonstrate:

Female, age twenty (No. 1519-'22), who had received an intravenous injection of acroflavine solution for the treatment of a septic endocarditis, showed a marked yellowish discoloration of the skin the day after the injection. The urine was deep orange and gave a yellow foam. Although it was suspected that this discoloration was an acroflavine staining, the possibility of some hepatic destruction with jaundice, as is occasionally seen after salvarsan administration, was considered. A normal icterus index of 5 definitely settled the question, excluding the jaundice possibility.

Male, age twenty-nine (No. 2106-'22), was admitted to the hospital with abdominal symptoms and the diagnosis of a high acute appendicitis or an acute cholecystitis. Examination revealed a definite consolidation of the lower lobe of the right lung and the patient was given an injection of acroflavine. The next day he appeared to be markedly icteric. His urine was dark orange and gave a yellow foam, although negative chemically for bile. It was appreciated that this yellow staining of the skin and urine was probably due to the acroflavine, but it was felt that possibly the patient might have a gall-bladder condition after all. His icterus index of 5.2 showed that the coloration of the skin and urine was not due to jaundice.

The following case is of more than usual interest:

Male, age twenty-three (member of house staff), gave the impression of being slightly jaundiced during a six months' period of observation. He stated that to the best of his recollection he had always had this subicteric hue which was at some times more marked than at others, although he has always been in good health. His icterus index was 16, due probably to a rather more than normal bilirubinemia, or as van der Bergh has designated the condition, a "physiological constitutional hyperbilirubinemia."

For the sake of completeness it might here be mentioned that the icterus index determination will assist in the diagnosis of jaundice and in the study

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of its progress in patients belonging to the dark-skinned races such as Negroes, Mongols, Hindus, etc.

B. In Latent Icterus.—As the test is one of extreme delicacy, it will indicate incipient or threatened jaundice, so-called "latent" icterus, before other evidence of this condition can be noted by the ordinary clinical signs. The following examples may be cited:

Male, age twenty-one (No. 3229-'21), was under observation for a suspected lesion in the stomach or duodenum. Although there was no jaundice, the icterus index of 9 called attention to the biliary system. At operation a definite chronic cholecystitis was found, the stomach and duodenum being entirely free from disease.

Male, age fifty-two (No. 6409-'21), with a carcinoma of the colon without clinical signs of jaundice or bile in the urine, was examined. An icterus index of 12 aroused suspicions of some hepatic involvement and laparotomy revealed extensive liver metastases. After operation the patient showed evident jaundice with bile in the urine and an icterus index of 56.

Male, age thirty-nine (No. 6165-'21), with no clinical jaundice and an icterus index of 8, was operated on for a doubtful abdominal condition. Owing to the rather higher than normal figure the gall-bladder region was explored and adhesions between the gall-bladder and duodenum were discovered with some distortion of the bile ducts. These adhesions were released and the icterus index after operation dropped to normal (4.2).

Female, age twenty-two (No. 1970-'22), gave a definite history of gall-stones with repeated attacks of colic and the passage of stones in the stool. She was admitted to the hospital without a trace, clinically, of icterus, but her index was 13.5. Operation disclosed marked omental adhesions to the gall-bladder, which was a typical strawberry organ, although no calculus was found. Eight days after cholecystectomy the icterus index had fallen to 3.7.

The possibilities in this direction are multiple. In doubtful colic, for instance, a high icterus index could be interpreted to indicate biliary origin as against a kidney lesion. The icterus index determination might help to differentiate an acute cholecystitis from a high appendicitis or a perforated gastric or duodenal ulcer, or chronic gall-bladder disease from ulceration or malignancy at or near the pylorus if there is no secondary involvement of the liver or bile tracts. In any doubtful case of right upper quadrant disease a high index would tend to indicate biliary or hepatic involvement as slight interference with the normal flow of bile seems to show color changes in the blood some time before this can be recognized in other ways, although naturally a low index would not necessarily exclude such a condition.

C. In Marked Icterus.—As yet a study of the initial figures in the various cases of jaundice examined does not seem to give much diagnostic information. The index in simple catarrhal jaundice or cholecystitis may be very high (female, private case of Doctor Rohdenburg, acute catarrhal jaundice, icterus index 128.2; male, age twenty-seven, No. 7368-'21, subacute cholecystitis and hepatitis, icterus index 210) while in calculous or carcinomatous obstruction it may be comparatively low (male, age forty-six, No. 3239-'21, impacted common duct stone, icterus index 56; male, age fifty-nine, No. 7172-'21, adenocarcinoma of liver, chronic pancreatitis with metastatic adenocarcinoma

of pancreas, icterus index 75; male, age fifty-nine, No. 7716-'21, carcinoma of head of pancreas, icterus index 75). This corresponds to the observation, made by the usual clinical methods, that the intensity of the icterus is no measure of the character, severity or permanency of the disease. If, however, the fluctuations in the index figures are noted some light may be thrown on the diagnosis.

A recession or remission in the index figures during an observation period, even without other clinical evidence, would, of course, suggest a movable obstruction due to inflammatory products or stone as against the naturally increasing index of a progressive occlusion due to carcinoma. It must be emphasized, however, that the converse of this proposition does not hold, for, as will later be shown, increasing figures may occur with an inflammatory obliteration of the common duct (female, age fifty-three, No. 4440-'21) or with a calculus tightly impacted in the papilla (female, age fifty, No. 6771-'21).

In catarrhal cases the index tends to fall rather rapidly often before a clinical change can be observed. Several such instances have been noted, but the following three are the most striking:

Female, age ten (No. 6975-'21), had a marked jaundice and an index which had risen to 100 on December 17, 1921. With no appreciable change in the coloration of the skin or eyes, the index on January 14, 1922, had fallen to 63. Shortly before this latter test the patient was examined by a surgeon, who advised operation for common duct obstruction. The operation, however, was not performed and from this point the jaundice, evidently a catarrhal form, rapidly cleared up.

Male, age forty-seven (No. 7368-'21), with intense jaundice, was examined, and showed an icterus index of 210. Several days later the blood was reexamined, and although there was no noticeable change, clinically, in the patient's appearance, the index had fallen to 75. In spite of this an exploratory laparotomy was done. Operation disclosed a distended and somewhat thickened gall-bladder, but no signs either of tumor or calculi. The liver was slightly enlarged and congested. The gall-bladder was easily emptied by compression and it was not removed. The patient made an uneventful recovery, but operation might have been avoided, had the significance of the rapid fall in the index figures been understood.

Male, age thirty-two (No. 944-'22), was admitted to the hospital with a diagnosis of either a catarrhal jaundice or a salvarsan hepatitis. He had a moderate jaundice and an enlarged liver. His icterus index rose from 115 on February 8, 1922, to 124 on February 18th, and only the merest trace of bile could be obtained from the duodenum by the Lyon's test. Following a course of "medical drainage" of the gall-bladder by means of the duodenal tube and magnesium sulphate instillations, the index dropped rapidly to 62.5 on February 24th, without much apparent change in the depth of the jaundice and with only a slight increase in flow of bile into the duodenum. On March 8th the index had fallen to 26, and coincident with this latter decline, the icterus cleared up except for a slight scleral pigmentation, the enlargement of the liver receded and the bile flow into the duodenum approached normal.

In pure obstructive jaundice, *i.e.*, jaundice due to occlusion of the hepatic or common duct, the rise in the icterus index seems much more definite and

ESTIMATING BILE IN BLOOD

rapid than in cirrhosis, hepatitis, metastatic carcinoma or other forms of hepatic destruction, especially of the chronic variety, as for example:

Male, age twenty-three (No. 3205-'21), had received several salvarsan injections and became deeply jaundiced. The index was 107 and remained around that figure over a period of four weeks' observation. As the patient failed to improve and there were only traces of bile in the duodenum, an exploratory laparotomy was performed. A somewhat congested liver was found with a contracted gall-bladder, no calculi and no evidence of obstruction of the common duct. A bougie was easily passed into the duodenum. After operation the patient's condition remained practically stationary and his icterus index fluctuated, during a two months' period, between 100 and 114. He finally left the hospital unimproved, with the probable diagnosis of hepatitis due to salvarsan.

Male, age fifty-one (Dispensary No. 319-'21), was under observation for a probable hypertrophic cirrhosis or carcinoma of the liver. He was quite jaundiced and his index was 70. Four months later his condition was not much changed and his index was 71.

2. *In the Placing of Operative Indications.*—The test appears to be of considerable value in determining whether an icterus is progressing or receding, and how rapidly this is occurring, and in helping the surgeon to decide when and if operative interference is indicated in obstructive jaundice. In this connection we have used the test in conjunction with the duodenal tube and the instillation of magnesium sulphate to help estimate the completeness of the obstruction.

Let us assume that a definite diagnosis of common duct obstruction due to calculus or other cause has been made. There is marked jaundice and a high icterus index. After several days, although there is no visible change in color of the skin or sclera or in the character of the urine, the icterus index has dropped say 30 points. The inference that the icterus is subsiding and that the calculus has been passed or has moved, or that the obstruction is at least partially relieved is justified, especially if bile can be obtained from the duodenum by the tube. This permits the surgeon to wait for a more favorable time for operation, either until the patient is less icteric or even entirely free of icterus, instead of being forced to operate under the various disadvantages that an intense icterus entails. Sometimes operation may even be entirely avoided. To illustrate this hypothesis, I need but to cite two of the cases referred to above, the case of catarrhal jaundice (female, age ten, No. 6975-'21) which barely escaped operation and the case of non-obstructive, subacute cholecystitis and hepatitis (male, age forty-seven, No. 7368-'21) which was operated upon.

As a contrast to the above situation, if it is found that the index is rising rapidly and that definite obstruction exists, operation may be undertaken often before the patient's condition becomes too critical.

Female, age fifty-three (No. 4440-'21), with marked jaundice, gave a history suggestive of cholelithiasis with common duct obstruction. The first figure was 125, which rose to 150 during the week, in which an attempt was being made to prepare her for operation by trying to shorten her coagulation time. At operation an inflammatory obliteration of the common duct was found.

A similar case was a female, age fifty (No. 6771-'21), with a deep icterus of some duration and a history of gall-stones, who gave an initial icterus index of 92. The patient was under observation a few days and given general stimulant treatment, when a subsequent test was made and the index had risen to 120. It was clear that the obstruction was total and progressive, which facts were verified by the duodenal tube. Operation disclosed a large, tightly impacted calculus in the papilla.

When the index remains more or less stationary, one should be cautious in advocating operation. This levelness of the icterus index curve, as has been pointed out above, seems much more likely to occur in chronic non-surgical diseases of the liver, such as cirrhosis, metastatic carcinoma and various other chronic hepatic inflammations and degenerations (male, age twenty-three, No. 3205-'21, salvarsan hepatitis).

3. *In Prognosis.*—In the prognosis of jaundice cases the initial index figures are obviously of as little assistance as they are in diagnosis. Some of the patients with the highest figures have recovered and some with the lowest have died either after operation or without surgical intervention, depending upon the nature of the disease. A study, however, of the variations in the icterus index is here, too, of considerable value and gives definite prognostic information, as illustrated by the following cases:

Female, age twenty-nine (No. 6138-'21), with a severe toxæmia of pregnancy and intense jaundice, was admitted to the hospital on October 12, 1921. The icterus index on the day after admission was 187. Leucin and tyrosin crystals were found in the urine, which also gave a marked bile reaction. On October 21st the index dropped to 62, jaundice still being very marked. The patient now began to show signs of improvement and from this point on made a rapid recovery. On October 25th the index was 31, the color of the skin somewhat lighter, but bile still present in the urine. On October 31st the index was 23 and on November 11th it was as low as 14. It should be emphasized that between October 13th, when the index was 187, and October 21st, when it had decreased to 62, no noticeable change could be detected in the color of the skin or sclera. Although it was realized that these forms of intoxication in pregnancy with marked hepatic involvement are usually fatal, the definite and rapid descent of the icterus index, in spite of the absence, in the beginning, of clinical signs of improvement, indicated that the recovery which eventually occurred would ensue.

An opposite picture with an ascending scale follows:

Female, age twenty-two (No. 5883-'21), developed an acute yellow atrophy of the liver after an injection of salvarsan. The patient was markedly jaundiced and bile, leucin and tyrosin were found in the urine. The icterus index rose steadily and rapidly until one day before death the figure was 210.

In post-operative prognosis the test may prove of service. If the index drops promptly after operation one may assume that the biliary obstruction has been relieved, that the jaundice is subsiding and that the patient is making a satisfactory recovery, even if this is not apparent clinically. An example of this nature is the following:

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Male, age forty-six (No. 3239-'21), presented a history of an intermittent common duct obstruction. When first seen he was moderately jaundiced and had an icterus index of 56. At operation I found a large solitary stone impacted in the choledochus at the junction of the cystic and hepatic ducts. The stone was removed, the shrunken gall-bladder extirpated, and the hepatic duct drained. Although no change could be noted in the patient's color, a few days after operation the index had fallen to 24, and the patient went on to an uneventful convalescence.

If the index rises or remains stationary after operation the assumption that conditions are not satisfactory would be justified, that, for instance, intrahepatic or hilus obstruction from cirrhosis or neoplasm still exists, in spite of duct or gall-bladder drainage outward or by cholecystenterostomy. The test may serve, too, as a rather reliable guide in the after-treatment of an operative case. Take, for example, a case of common duct stone with hepatic drainage, in which the index is not falling properly or even rising. There may be a fair amount of biliary drainage through the drainage tube, no change may be noted in the patient's appearance but the index curve would indicate some imperfection in the drainage system which could be corrected. Should a choledocholithotomy with subsequent suture of the duct and without hepatic drainage have been performed, the fall or rise of the index figures would be most informative in connection with the post-operative prognosis and treatment. Accidental ligation of the hepatic or common duct during cholecystectomy, secondary stenosis of these structures, or the retention of a calculus in the common duct and its impaction at the papilla would all be indicated by a sharp and progressive rise in the icterus index, if there is no biliary fistula. This behavior of the index would be of great assistance in helping the surgeon decide on the question of reoperation and would influence him long before a decision could be reached by his observation merely of the patient's clinical manifestations.

CONCLUSIONS

In conclusion it may be stated that the icterus index determination is of value from the surgical standpoint:

1. As an indicator of the absence or presence of jaundice and as an aid to diagnosis in doubtful cases, being more dependable and delicate than the inspection of the skin and sclera, or the examination of the urine.
2. As a method of accurately estimating, in frank icterus, the pre- or post-operative increase or decrease in the degree of jaundice with the accompanying progression or recession of the disease.
3. As a guide in differential diagnosis, in the placing of operative indications and in prognosis, in cases of outspoken jaundice, by means of the study of the fluctuations in the index figures.

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THE SURGICAL TREATMENT OF CHOLELITHIASIS, CHOLECYSTECTOMY AND CHOLEDOCHOTOMY

CONTINUOUS OUT-DOOR TREATMENT

By SIR JOHN O'CONOR, M.D.

OF BUENOS AIRES

SOME eight years ago¹ I invited attention to this subject—"After considerable experience in biliary surgery I have been forced to the conclusion that nothing short of cholecystectomy affects permanent cure in the great majority of cases commonly known as attacks of gall-stones," and this statement was, at the time, made in face of the fact that in Keen's Surgery a well-known collaborator asserted, "the danger of re-formation of gall-stones after cholecystostomy is exceedingly small." Since my original essay was published, I have had ample opportunity for clinical reflection, and feel that the more I see of this malady the more convinced am I that the opinion therein expressed was correct.

The direct object of this communication is to present a method of cholecystectomy and of choledochotomy which is simple in execution, which admits of operative rapidity² in a zone in which indefinite manipulation is likely to cause shock, which reduces hemorrhage to a minimum, and which from start to finish permits of one being able to see what one is doing.

Ether by the open method is administered, patient placed in the Robson position, and alcohol mercurial² skin disinfection completed.

A five-inch incision is made in the right semilunar line. After opening abdomen, some moments are devoted to careful examination of the local condition, which includes deliberate palpation of the common and hepatic ducts between the right thumb and right index finger inserted into the foramen of Winslow.

The affected zone is then isolated by towels and bibules, every visible nook and corner is meticulously packed so as to obviate any subsequent contamination of the general cavity.

Two large retractors, embracing the whole parietal wall, held by assistants on opposite sides, expose the operative field.

The summit of gall-bladder is seized by two strong pressure forceps, about one inch apart, which are respectively handed to the assistants who make gentle opposing downward and forward traction while the peritoneal line of adhesion of gall-bladder to liver is lightly incised by a sharp scalpel.

A bibule rolled up to about size of finger is then brought into action, by a gentle rolling process with this gauze cylinder the vesicle, in a few moments, is liberated from the fossa fellæ—without any hepatic laceration, and with comparatively trivial loss of blood—if any tough strands of tissue

resist bibule persuasion, they are snipped through with scissors, and complete separation by the "roller" is effected right down to the level of the cystic duct.

As I consider this detail (which is the more feasible the more the gall-bladder is distended) a winning stroke in the operation, I do not hesitate to interpolate that I do not know of any infected internal organ which may be so easily enticed from its habitat—without traumatism and without hemorrhage—as a tense infected gall-bladder can be coaxed out of its hepatic bed by the judicious use of a roll of dry gauze.

An inspection is, at this juncture, made of the peritoneal packing and supplemented, if necessary, by additional sponges.

With a kidney basin in position the portion of the gall-bladder, grasped previously between forceps, is freely opened and contents evacuated.

With a few more touches of scalpel this incision is immediately extended, above and below, to within half an inch of the orifice of the cystic duct, the two deep angles of the incision are then seized by forceps, and the divided cystic artery ligated.

The four forceps, *viz.*, the two originally applied to the fundus, and the two just attached to the deep angles of wound, are grasped in the palm of the left hand, and, with the tip of left index finger fixed in the remaining cystic pelvis, outward tension is made while the right fingers make a final palpation of the ducts.

If a calculus is encountered in the cystic duct it is usually coaxed out by finger pressure through the cystic orifice; failing this, more forcible methods are adopted.

Whenever a gall-stone is found in the common duct, the assistant on the right takes hold of the four forceps, making gentle outward traction on the split gall-bladder, the operator walks round to the opposite side of table (left side of patient) and passes his left index finger into the foramen of Winslow, when the calculus is definitely located it is pushed forward and firmly secured *in situ* by forward pressure of this left finger while the knife in the right hand makes a suitable incision directly over the bulging calculus. When the concretion is removed, a methodical search is made for others, and if any are found, they are kneaded out between the fingers through the same opening.

I do not know of any instance in surgery in which a temporary change of position, on the part of the operator, is attended with more helpful results than the change from right to left in this procedure—the left index finger supinated and slightly flexed behind the duct transforms a deep and dangerous operation into a superficial and simple one.*

Position is then resumed on the right side of the patient, taking hold of the four master forceps, and replacing the tip of the left index finger in

* I have abandoned the use of sutures to close the wound in the common duct; it generally closes spontaneously within fourteen days, and in these cases a few days drainage is beneficial.

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cystic pelvis, while an assistant applies a ligature around cystic duct just below the tip of the operator's finger and the two flaps of gall-bladder are then excised. Catgut is used in presence of mucus or pus, otherwise I prefer silk for this purpose.

In case the common duct has not been opened, if there is the slightest suspicion of cholangitis or toxæmia the two large flaps of gall-bladder are snipped away by a curved scissors close to cystic orifice, bleeding vessels secured and no ligature is applied around the duct, which now serves as a useful drain pipe.

Thorough inspection is then made of "the pit"—if dry the parietal wound is closed by through-and-through sutures—if oozing is visible temporary packing is resorted to, followed by the insertion of one end of a wisp (twenty strands doubled and tied at ends) of silkworm gut into the depth of wound—the other end is extruded through the upper angle of the parietal opening. (Occasionally it may be necessary to retain the gauze pack *in situ* for forty-eight hours.)

Whenever mucus or pus is met with, drainage is invariably adopted³—preferably with silkworm gut.

My experience dictates closure of all abdominal wounds above the umbilicus by through-and-through strong silk or double silkworm gut stitches and below by absorbable tier sutures. In the former removal of sutures is begun on the tenth day and concluded on the thirteenth—the day before abdominal cases are allowed to sit up.

If there is any indication of shock, a pint of champagne is run into rectum⁴ before the patient leaves the operating table. When in bed the electric heating cage is applied, subcutaneous serum drip started, hypodermic injection of digitalin and strychnine given every six hours with an occasional injection of pituitary extract, and as much iced champagne, brandy and water, or citrate water as the patient wishes to sip; nutrient and saline rectal injections are given, alternately, every three hours.

Since 1905 all grave septic cases under my care in hospital have been transferred as soon as feasible to "the continuous outdoor." In the *Lancet*, May 29, 1915, I made the statement "In serious cases of acute operative toxæmia we have found the placing of the patients out of doors⁵ immediately after operation to be of marked benefit," and after a total experience of sixteen years it is pleasant to be able to record⁶ that the results have been most gratifying, due to the fact that "the sappers" glory in the fresh air, they love a bit of sun—both of which tend to "get their blood up" to such a standard that their work becomes visible in the daily increase in the color, vigor and appetite of their host—to which may be added immunity to the pneumococcus.

For some years past I have made it a rule to get abdominal patients out of bed on the fourteenth day after operation. At one time I thought it was very smart to have these cases walking seven days post-operative, but

SIR JOHN O'CONOR

some untoward occurrences forced the conclusion that the practice of allowing active body movement before physiological healing has had time was contra-indicated.

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MALIGNANT NEOPLASMS OF THE EXTRAHEPATIC BILIARY DUCTS*

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FELLOW IN SURGERY MAYO FOUNDATION

CANCER of the bile ducts as a clinical and pathologic entity was not recognized previous to the middle of the nineteenth century.

Rokitansky considered that the ducts were involved by secondary growths from near-by organs, and the majority of his contemporary workers agreed with him. Schueppel, in 1878, described the first cancer of the hepatic canal. Durand-Fardel, in 1840, reported the first case of cancer of the common duct, and, according to Mayo-Robson, cancer of the ampulla was first described by McNeal in 1835.

Since 1889 there have appeared reports of collected cases by Musser, Claisse, Devic and Gallavardin, Rolleston, and Outerbridge.

In 4578 necropsies Kellynack found eight cases of carcinoma of the gall-bladder and only two of the ducts. Of 511 operations on the gall-bladder and bile ducts at the Mayo Clinic previous to March, 1903, twenty-two were for malignant disease, and in six of these the growth was believed to be primary in the bile ducts.

PATHOLOGY

Carcinoma of the bile ducts is usually of the columnar-cell type, according to Ziegler, MacCallum, and Ewing. Rolleston believes that the majority of carcinomas of the bile ducts are derived from the surface epithelium, although he says, "It is possible that spheroidal-cell carcinoma of the bile duct may be derived from the mucous glands in its wall." In an analysis of forty-three cases, he found thirty-seven columnar, five spheroidal, and one colloidal in type. Mucoid degeneration of columnar cells, or transition from columnar to spheroidal cells, may take place. Metaplasia may result in the formation of squamous-cell carcinoma, as in the gall-bladder.

Duval describes a case of primary melanoma of the ampulla. No reference to sarcoma was found in the literature. Mayo-Robson and Rolleston both assert that cancer of the head of the pancreas is spheroidal-cell, while cancer of the ducts is almost always of the columnar type. According to MacCarty, the truth of this statement depends on the stage of cellular differentiation, but from a practical point of view this distinction seems to be of little value. According to Ewing, it is difficult, if not impossible, to determine the origin of tumors in the region of the papilla, since they may arise from the intestinal, pancreatic, or biliary tracts.

*Abridgment of theses submitted to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Surgery, April, 1922.

Cancer of the biliary passages most often occurs in the common duct. The lesions in Rolleston's ninety cases were located in the common bile duct in thirty-four (lower end twenty-three, upper end eleven), in the junction of the cystic, common, and common hepatic ducts in twenty-seven, in the common hepatic duct in nineteen, in the right and left hepatic ducts in three, in the cystic duct in six, and in the cystic and lower end of the common duct in one each.

The growth is usually confined within the walls of the bile ducts; it may project into the lumen, or from an annular stricture, or it may spread along the tube in a diffuse manner, causing obstruction, sooner or later, in all. Extension is usually limited to the walls of the bile duct. By infiltration papillary tumors may invade the liver through the bile ducts, but usually this takes place by the portal lymphatics.

Metastasis seldom occurs; Devic and Gallavardin found metastatic growths in twenty per cent. of cases. In Musser's eighteen cases metastasis occurred in the liver in seven, in the mesenteric glands in one, in the peritoneum in one, and in the pancreas in one. Distant

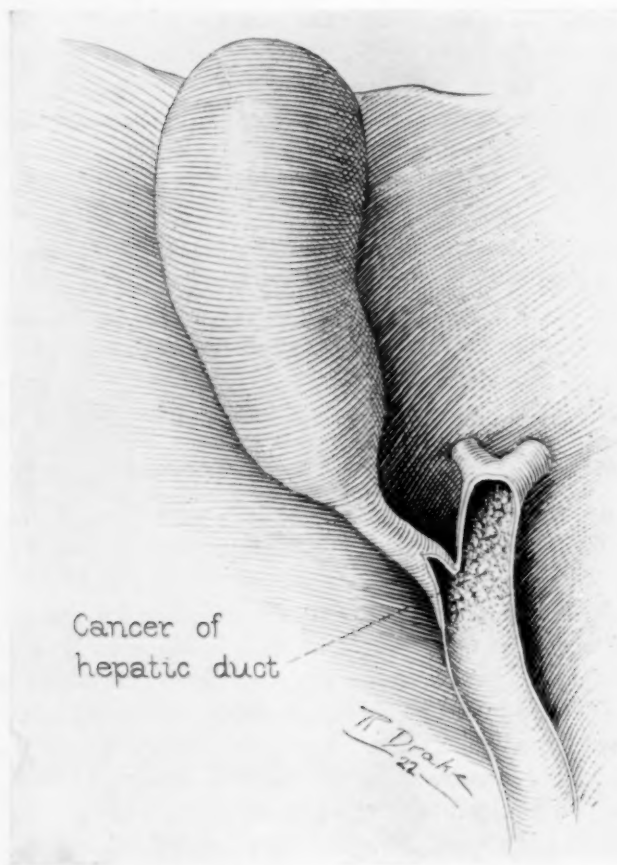


FIG. 1.—Cancer of the hepatic duct, probably originating at junction of hepatic and cystic ducts.

metastasis occurs very rarely. Paynton reports a case of cancer of the common duct, with rapid distant metastasis and death without jaundice. On exploration, small nodules in the liver produced by peripheral dilation of the small intrahepatic bile ducts may be mistaken for metastasis.

The calibre of the ducts remains normal below the growth, while above, the ducts are dilated. In Musser's eighteen cases the ducts were dilated in nine. In patients with involvement of the hepatic or juxtohepatic portions of

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the ducts, the gall-bladder is, as a rule, small; at times, however, it is found distended with mucus or in an empyematous condition (Figs. 1 and 2). In cases of tumors involving the common duct or the ampulla the gall-bladder is dilated, unless it has been previously bound down or retracted by infection and stones. In fourteen cases of cancer of the hepatic, common, and cystic ducts reported by Devic and Gallavardin, the gall-bladder was dilated in seven, normal in three, and retracted in four. In ten cases of cancer of the hepatic duct observed at necropsy, the gall-bladder was not mentioned (probably retracted) in three, retracted in four, normal in one, and dilated in two. According to Courvoisier, the gall-bladder is enlarged in eighty-four per cent. of patients with cancer of the duct. The liver is either enlarged or smaller than normal, with dilated ducts filled with bile or clear mucus-like material. Fütterer describes an icteric necrosis in the central zone of the liver lobule with the rest of the structure remaining comparatively normal. He considers this to be due to a reversal of flow of bile to the lymph

channels, and Herring and Simpson, in experiments on bile pressure, have described a similar reversal of the bile stream.

ETIOLOGY

Zenker is of the opinion that primary cancer of the ducts begins as a papilloma and Rolleston reports a case which seems to support this theory.



FIG. 2.—Cancer of the cystic duct with a large empyematous gall-bladder.

Mayo-Robson recognizes the possible association of malignancy of the ducts with papilloma, but believes that gall-stones are a greater etiologic factor than is generally conceded. Rolleston says, "It is conceivable that carcinoma of the bile ducts may supervene on an old ulcer as it does in gastric carcinoma." MacCarty³³ presents two cases with reports and photographs of specimens showing duodenal ulcers located at the papilla with definite involvement of the ampulla. In both cases the outstanding symptomatic features are those of gall-bladder disease with symptoms of obstruction.

In Rolleston's series of cases of primary cancer of the ducts, gall-stones were present in about one-third. This percentage is in marked contrast to cases of cancer of the gall-bladder, as stones occur in about seventy per cent. of these. This is supported by Devic, and Gallavardin's and Outerbridge's findings. Keen is of the opinion that cancer arising in the excretory ducts of the liver is seldom associated with stones. McGlinn, however, found eleven cases of cancer of the gall-bladder in 9000 necropsies; eight were associated with gall-stones. In each of five cases of cancer of the bile duct, stones were found. Conradi, in a series of necropsies, found stones in the common duct in nearly fifteen per cent. of cases of cholelithiasis, and White concluded that twenty per cent. of all persons with gall-stones ultimately develop cancer of the biliary passages. Heredity as an etiologic factor is apparently of little importance.

AGE AND SEX

Cancer of the bile ducts, in marked contrast to cancer of the gall-bladder, shows a predilection for males. Rolleston notes fifty-five males and thirty-five females; Devic and Gallavardin, thirty males and sixteen females; in Musser's cases they were equally divided.

Like cancer of the gall-bladder, cancer of the ducts is most common between the ages of fifty and seventy. Fifty-eight of Rolleston's eighty-three cases averaged over fifty years, with practically no difference in the two sexes. In Miodowski's series twenty-three were between fifty and seventy, five were over seventy, and eleven were between thirty and fifty.

The clinical picture in malignancy of the ducts is, as a rule, that of an obstructive jaundice, the picture varying with the location of the growth and the associated conditions, such as infection, stones, or pancreatitis. According to Upcutt, the most striking features of the clinical picture are absence of pain, intensity of the jaundice, and extreme emaciation. Rolleston classifies the clinical pictures as follows:

1. Insidious onset, and the first symptom generally jaundice.
2. Acute onset of gastro-intestinal symptoms followed by jaundice, suggestive of ordinary catarrhal jaundice.
3. Vague dyspeptic symptoms for some time preceding onset of obstructive jaundice.
4. Sudden onset of colicky pain simulating impaction of stone.

CANCER OF EXTRAHEPATIC BILE DUCTS

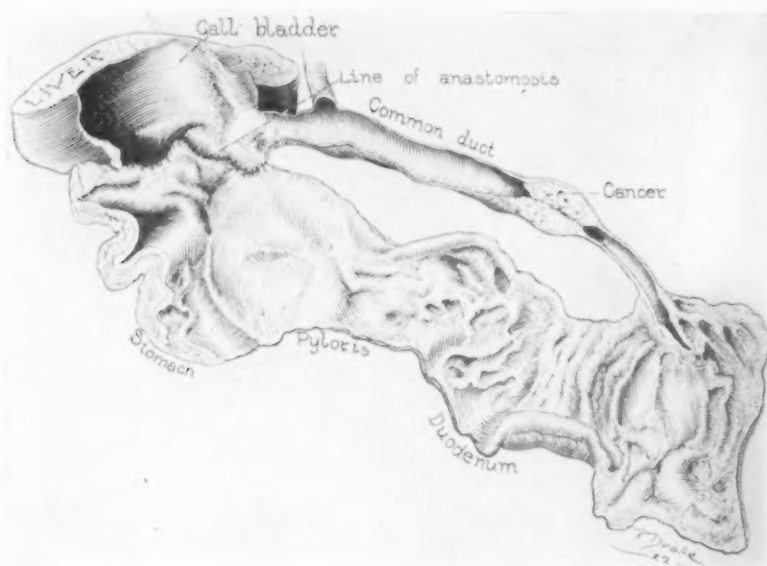


FIG. 3.—Cancer of common duct; ducts dilated above. Cholecystgastrostomy.

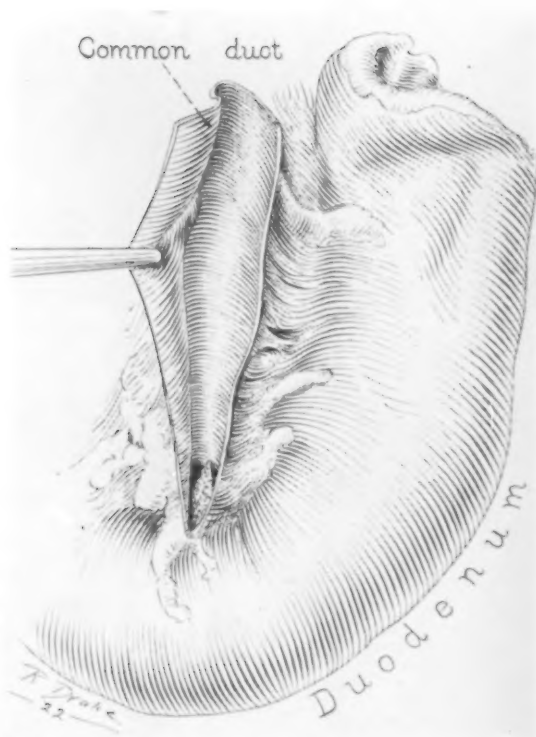


FIG. 4.—Extension of cancer of the ampulla and papilla up into the common duct. Duct dilated.

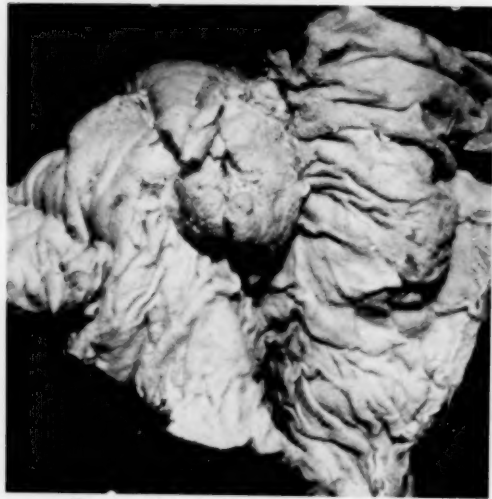


FIG. 5.—Cancer of the ampulla and papilla.

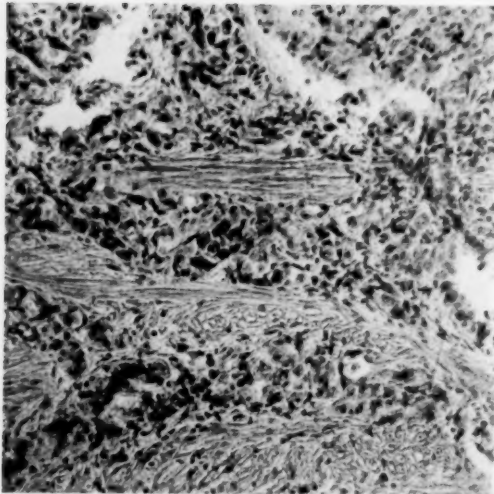


FIG. 6.—Carcinoma of the common duct, mainly cuboidal cells with a tendency to acinus formation (x 100).

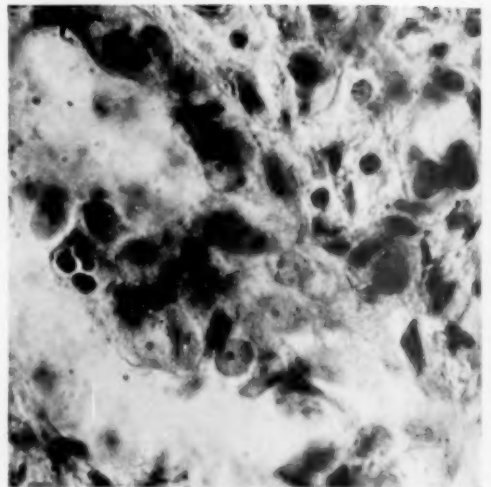


FIG. 7.—Carcinoma shown in FIG. 6.

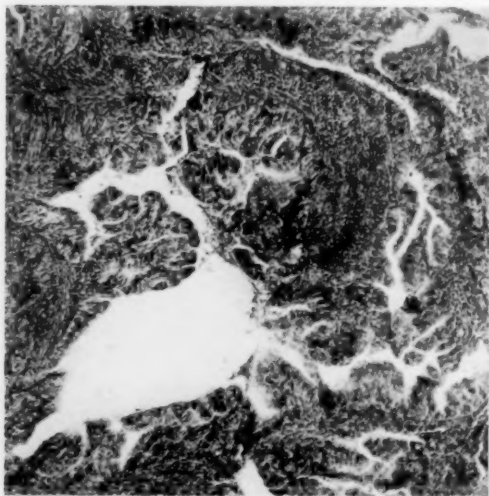


FIG. 8.—Adenocarcinoma of the common duct. Tendency to papillary formation (x 50).

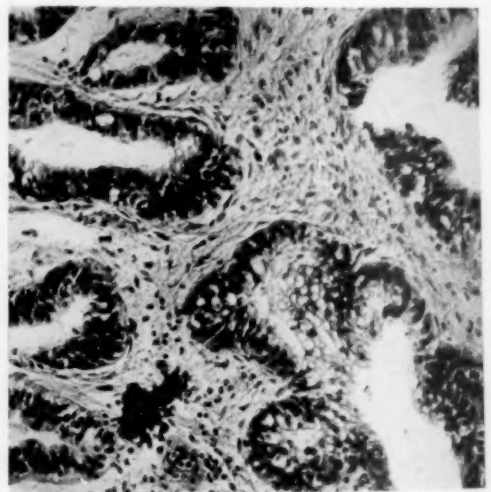


FIG. 9.—Adenocarcinoma shown in Fig. 8 (x 100).

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SURGICAL TREATMENT

The surgical treatment of patients with malignancy of the ducts is either palliative or radical. The pancreatic duct cannot be treated radically and there is a choice of hepatochoangiostomy, with all the objections of a skin fistula and the consequent loss of bile, or hepatochoangio-enterostomy, first suggested by Baudouin in 1896.

Cotte advises hepatochoangiojejunostomy in Y, with the anastomosis to the anterior portion of the left lobe of the liver, because in this part the hepatic duct takes a direct course throughout and has only a short branch, although a fistulous connection is more likely to develop. A jejunostomy in Y is performed with a view to lessening the amount of the ascending infection.

Separate consideration of the cystic duct is not necessary, because its treatment is the same as that for the confluent type; that is, cancer of the cystic, common, and hepatic ducts.

Cancer of the confluent type may be treated by resection of the involved parts, or reestablishment of biliary continuity.

Quénu and Tuffier place the cut end of the duct in the stomach, while Kehr, Terrier and Vautrin place it in the duodenum. Mayo²⁸ and Jaboulay advise end-to-end suture of the common and hepatic ducts. Cotte advises use of the T-tube because he believes

it saves time. Sullivan, in experimental work on dogs, describes the formation of a new duct. He places pure rubber tubing 0.6 cm. in diameter into the pancreatic duct, fastens one end with permanent suture, and passes the other end through the duodenum according to the method of Witzel. The tube is finally covered by omental graft.

Palliative operation in cancer of the confluent type in the presence of infection consists in a cholecystostomy to relieve infection, and to decrease constriction in the duct below by lessening the spasm. This procedure is comparable to gastrostomy with stricture of the œsophagus in which sounds may be passed following gastrostomy. In cancer of the confluent type with little or no infection, some form of anastomosis between the biliary tract and the intestine can be utilized, depending on the site and extent of the lesion. The anastomosis may be between either the gall-bladder or the hepatic duct and the intestinal tract. If the gall-bladder can be used, a cholecystogastrostomy, colostomy, or enterostomy may be performed. Mayo-Robson prefers an anas-

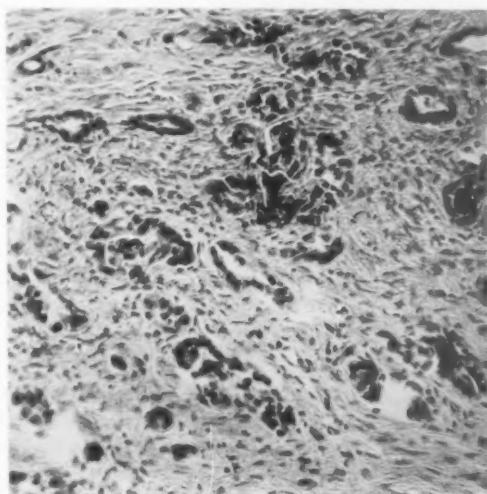


FIG. 10.—Adenocarcinoma (low cuboidal cell) of the common duct (x 100).

tomosis with the colon, as it is easier, and W. J. Mayo³⁷ says, "From my experience I see no reason why the colon cannot be used as well as any part of the intestinal tract," and again, "We have joined the gall-bladder to the colon five times for chronic pancreatitis and the patients did fully as well as five patients in whom the duodenum was used. One patient is living five years after operation." Winiwarter, in his original works, considered cholecystocolostomy the method of choice.

Cholecystogastrostomy may be used, and, according to the experimental work of Oddi and the clinical experience of many later surgeons, the presence of bile in the stomach before and during the period of digestion in no way diminishes the power of digestion (Fig. 3).

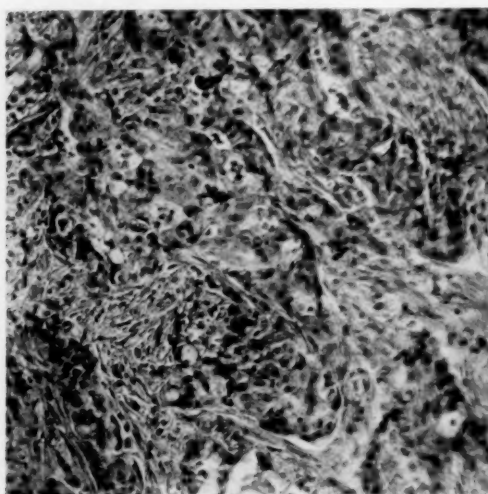


FIG. 11.—Adenocarcinoma of the common duct (x 100).

transduodenal excision of Halsted, and (3) transduodenal excision or cauterization of the papilla and part of the duodenal wall.

Halsted reports what he believes to be the first case of transduodenal excision for cancer of the ampulla with transplantation of the ducts. The patient died six months after operation. To McBurney belongs the credit for first adopting the method of transduodenal exploration previously suggested by Langenbuch in 1884. Cuneo reports a case similar to Halsted's in which marsupialization of the pancreas was carried out, and the patient died the second day. Retroduodenal resection of the common duct may be performed in these cases.

Occasionally operations on the gall-bladder and ducts are followed by posterior gastro-enterostomy, but Hartman believes that this is seldom necessary, as the great danger is from ascending infection rather than from duodenal obstruction. According to Hartman and others, this infection may be overcome by draining the common duct or gall-bladder. Coffey, from experi-

used in the performance of the cholecystenterostomy type of operation: the Murphy button anastomosis, or some form of suture anastomosis. Moynihan⁴² found it necessary to perform a cholecystenterostomy only once, and in that case he chose the method of suture anastomosis.

Similar palliative operations may be utilized for cancer of the ampulla and papilla, as in other parts of the biliary tract (Figs. 4 and 5). Types of radical operations available in cancer of the ampulla and papilla are: (1) circular excision of Korte, (2)

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mental work on transplantation of the bile ducts in dogs, believes infection can be overcome by his method of transplantation.

Kausch devised and carried out successfully a very radical two-stage operation for extensive cancer of the ampulla and duodenal papilla. A Murphy button cholecystenterostomy is followed in two months by resection of part of the duodenum along with the tumor, division and ligation of the common duct, division of the head of the pancreas, gastro-enterostomy, and marsupialization of the stump of the pancreas in the open end of the duodenum. Kausch's patient made a good recovery. Korte advises similar operation.

Brewer asserts that cholecystenterostomy is dangerous and carries with it a mortality of seventy-five per cent.

Quénu reports eighteen collected cases in which radical operation was followed by twelve deaths, sixty-six and six-tenths per cent. Two of the remaining six cases were excluded because of metastasis. The other four patients lived an average of fifteen months (longest two and one-half years, shortest six months).

Lewis reports the case of a patient operated on by Kelly, well eight and one-half years after radical extirpation of cancer of the ampulla.

Deaver and Ashhurst give a rather extensive summary of the various types of operations, with the mortality.

Upcott believes the greater percentage of deaths to be due to hemorrhage. Hepatic inefficiency, cholemia and shock are undoubtedly contributory causes.

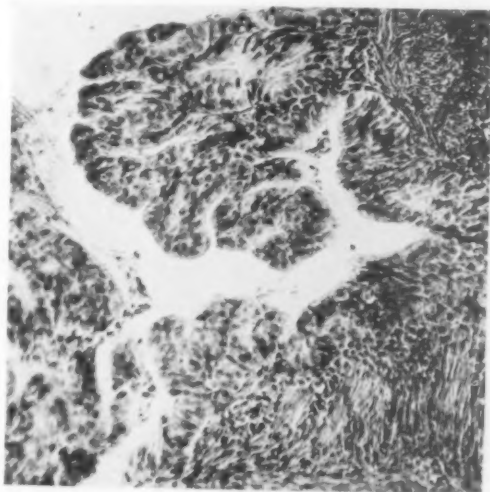


FIG. 12.—Papillary carcinoma of the ampulla of Vater (x 100).

MAYO CLINIC SERIES

From January, 1907, to January, 1921, twenty cases of primary carcinoma of the bile ducts were confirmed by pathologic examination at the Mayo Clinic. Eight were of the adenomatous type, two of the papillary type, and all with columnar, cuboidal, or spheroidal cells. Grossly they varied from the annular constricting to the flat, diffuse, and occasionally villous type (Figs. 6 to 13).

The common duct was most often involved. In twelve cases the growth was in the common duct; in four it was at the juncture of the common and cystic ducts, in two at the juncture of the common, cystic, and hepatic ducts, in

one at the upper end of the common duct, and in one at the lower end. In one specimen examined at necropsy the common duct was involved throughout the lower one-third. The hepatic duct was involved once, being associated with disseminated cancer of the intrahepatic bile ducts, probably by direct extension. The cystic duct was involved twice, and the ampulla and papilla five times, one obstructing annular type of growth in the ampulla, and one involving the head of the pancreas.

All but two of the twenty patients were operated on; three patients were explored, palliative operations were performed on eleven, radical operations on four. Specimens were obtained at necropsy in the two patients not operated.

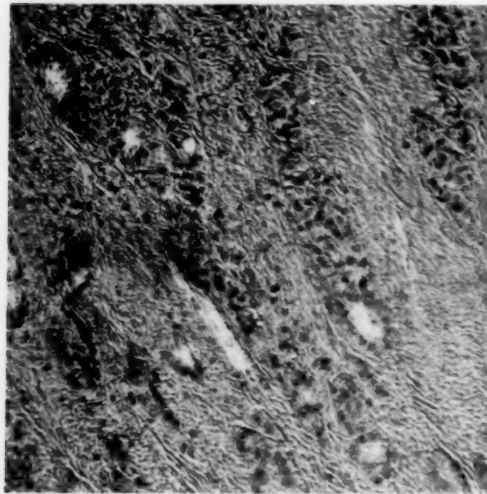


FIG. 13.—Carcinoma of the ampulla (x 100).

Stones were found in eight cases, stony material in two. Stones were found only in one of the five cases in which the growth was at the ampulla. Cancer of the hepatic duct was not associated with stones, while in both cases of cancer of the cystic duct stones were present. Stones were present in five of eleven patients with cancer of the common duct. There was a family history of cancer in only two cases. Thirteen patients were males and seven females. The oldest was seventy-eight years, the youngest twenty-five.

Years	Patients
21-30	1
31-40	3
41-50	2
51-60	7
61-70	5
71-80	2

SYMPTOMS

The average duration of obstructive symptoms was five months, the longest fourteen months (cancer of ampulla), the shortest one month (exploration showed metastasis to the liver). Eleven of the patients gave a history of gall-bladder or gall-stone disease preceding the onset of obstructive symptoms, for an average period of five years (longest nine years), while nine of the patients did not give a history of previous trouble. The average loss of weight of fifteen patients was 9.5 kg., associated in the majority of cases with considerable loss of strength. Twelve of the patients had pain varying

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from soreness or dull ache in the epigastrium or right hypochondrium to severe typical gall-stone colic, with radiation to the back and shoulders in eight instances. Four patients without stones had typical colicky pains.

All of the twenty patients were jaundiced; eleven constantly, eight intermittently. From the history one could not determine whether the jaundice was of the yellow or green type. Pruritus was definitely present and associated with jaundice in eleven instances, while in five it preceded jaundice. Seventeen patients had clay stools, two had diarrhoea, and one had normal stool. The urine of fifteen contained bile; albumin was present in most instances.

Hemorrhage, as evidenced by petechiæ, purpura, or ecchymosis, was noted five times; one patient had ecchymotic spots over her entire body, and another patient, not operated on, had copious hemorrhage from the bowel the day before death.

Courvoisier advises a search of the history and a careful examination of the entire body in order to ascertain whether or not a predisposition to hemorrhage exists. He says, "Operation may be fatal from hemorrhage not associated with the wound."

In sixteen cases the coagulation time averaged eight minutes; it was ten in four. The liver was palpable in ten cases, the gall-bladder in six, and the spleen in four. Ascites was present in three cases. Chills and fever were noted in seven. Nausea and vomiting seldom occurred after the onset of obstructive jaundice.

DIAGNOSIS

The diagnosis of malignant conditions of the bile ducts is as difficult, if not more difficult, than that of malignant conditions of the gall-bladder. Usually the chief symptoms are those of a preceding or accompanying gall-bladder or gall-stone disease with insidious or sudden development of symptoms of obstructive jaundice. The obstructive symptoms may appear alone without a previous history of trouble, and may or may not be associated with pain, colic, chills, and fever. Occasionally, the important features are diarrhoea and pasty stools, followed by jaundice. Jaundice is the one almost constant feature and may be preceded or followed by distressing pruritus. Loss of weight and strength is, as a rule, marked. A tumor may or may not be felt and with the possibility of numerous extrahepatic conditions producing the obstruction, a diagnosis other than obstructive jaundice is almost impossible. In a male in the fifth or sixth decade of life with a history of insidious persisting obstructive jaundice, malignancy of the ducts is always possible.

Moynihan says, "No one living is infallible in the differential diagnosis of obstructive jaundice, the diagnosis is always difficult and the chance of life saved is so important, that, however positive the evidence of malignancy may be, I have advised operation in all cases."

KINSLEY RENSHAW

DIAGNOSIS IN TWENTY CASES

	CASES
Obstructive jaundice, malignancy questionable	9
Obstructive jaundice, stones or malignancy	8
Cholangitis	1
Disease of the gall-bladder	1
Cirrhosis or malignancy	1

TYPES OF OPERATION

Of eighteen operations, three were explorations, eleven were palliative, and four were radical. Metastasis was found in four cases; two of cancer of the ampulla with metastasis of the liver, one of cancer of the ampulla involving the head of the pancreas by direct extension, and one of cancer of the hepatic duct with metastasis to the liver (at necropsy this appeared to be by direct extension along the ducts). Pancreatitis was noted seven times, and cirrhosis seven times. In three cases the ducts contained white bile.

RESULTS

The operative mortality of this series of cases (thirty-three and three-tenths per cent.) compares favorably with that reported by others. The average post-operative length of life of thirteen patients of the series was a little more than five months, one patient living fifteen months and another a little more than three years.

Case (A118598). The patient came to the Clinic with a history of diarrhoea of fourteen months' duration, jaundice, weakness and anæmia, gradually increasing pain in the right costal margin, with periods of remission. Cholecystostomy had been performed elsewhere about two months previously, and was followed by a persistent biliary fistula and loss of forty pounds in weight; the hæmoglobin was twenty-five per cent. Death occurred eighteen months after the onset of symptoms. Necropsy revealed primary cancer of the ampulla with involvement of the head of the pancreas.

Case (A340400). The patient had been well until five months before. Following a big dinner, indigestion occurred with very loose, mushy stools, and jaundice two weeks later. There was no history of colic, chills, fever or hemorrhage. The liver and gall-bladder were enlarged and pruritus was severe. The blood urea was 106, urea nitrogen fifty, phenolsulphonephthalein return thirty-five per cent., hæmoglobin sixty per cent., coagulation time nine minutes. The patient lost thirty-five pounds in weight. While under observation petechial hemorrhages developed with marked bleeding from the bowel the day before death. Death occurred about six months after onset of symptoms. Necropsy revealed carcinoma of the common duct, and chronic pancreatitis.

The twenty cases of malignancy of the biliary tract were divided into four groups.

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TABLE I

Case	Location	Exploration	Duration of life
A115806	Common duct	Abdominal incision, specimen for diagnosis	Six weeks
A45192	Common duct	Abdominal incision, specimen for diagnosis	Left the hospital seventh day
A208988	Ampulla	Abdominal incision	Ten days
PALLIATIVE OPERATION			
A197147	Hepatic duct	Cholecystostomy, liver puncture, and drainage	Forty-eight hours
A91510	Cystic duct	Cholecystostomy, specimen from cystic duct	Dead. Date unknown
A253416	Common duct	Cholecystostomy, specimen for diagnosis	Seven days
A207955	Common duct	Cholecystostomy, specimen for diagnosis	Dead. Date unknown
A163919	Common duct	Cholecystostomy and choledochostomy with T-tube extending through common duct into pancreatic duct and duodenum	Five months
A66344	Common duct	Choledochostomy with T-tube drainage	Five months
A62646	Common duct	Cholecystoduodenostomy (Cholecystostomy previously, elsewhere)	Two months
A137890	Common duct	Cholecystogastrostomy	Twenty-four hours
A74038	Common duct	Cholecystectomy with removal of part of the anterior wall of the common duct; Robson hepaticus drain	Two months
A226626	Ampulla	Choledochostomy with transduodenal exploration, specimen from papilla	Fifteen months
A180037	Ampulla	Cholecystogastrostomy. (Patient returned with pyloric obstruction, posterior gastro-enterostomy.)	Three years
RADICAL OPERATION			
A120992	Cystic duct	Cholecystectomy, resection of cystic duct with involved parts of common and hepatic ducts, anastomosis over T-tube	Three months
A35861	Common duct	Choledochotomy, cholecystectomy with removal of all the cystic duct and part of the common duct plastic on common duct.	Result unknown
A253761	Common duct	Excision of growth of common duct with end-to-end anastomosis; interrupted sutures	Result unknown
A269833	Ampulla	Choledochotomy, transduodenal excision (knife and cautery) cholecystoduodenostomy	Nine days

KINSLEY RENSHAW

Group 1. Cases in which there was a history of gall-stone disease for a variable period, later associated with or followed by symptoms of obstructive jaundice.

Group 2. Cases in which the history of gall-bladder disease was variable for a number of years, later associated with or followed by symptoms of obstructive jaundice.

Group 3. Cases in which symptoms of obstructive jaundice developed, the insidious, painless type, or associated with pain.

Group 4. Cases in which there was a history of diarrhoea and pasty stools, of the pancreatic type, followed later by symptoms of obstructive jaundice.

DISCUSSION

Surgical treatment of malignant conditions of the biliary tract has not advanced proportionately with that of other parts of the upper abdomen. Technical difficulties themselves do not seem to be responsible for this comparative tardiness.

Apparently the element that either prevents operation or causes failure, in a large percentage of cases, is hemorrhage. Recent clinical investigations on the control of hemorrhage in jaundiced patients by the intravenous administration of calcium have been carried out by Walters of the Mayo Clinic, and seem to advance some hope for better results in these cases. Certain pre-operative and post-operative principles designed to conserve and stimulate the activity of the cells of the liver were recently reiterated and emphasized by Crile.

If it were not for hemorrhage, malignant conditions of the biliary ducts, being as a rule small, limited within the walls of the bile ducts, and late to metastasize, should lend themselves readily to surgical treatment.

CONCLUSIONS

1. Malignancy of the bile ducts, while less common than that of the gall-bladder, is not uncommon. The ratio in a series of 104 cases of malignancy of the biliary ducts and gall-bladder was one to four.³⁶
2. Carcinoma is the most common type of neoplasm found.
3. Gall-stones would seem to be of greater etiologic importance than is generally considered.
4. Males and females are affected in the ratio of about two to one.
5. About two-thirds of the cases occur between the ages of fifty and seventy years.
6. A diagnosis of malignancy of the ducts is uncertain.
7. After a diagnosis of obstructive jaundice has been made, exploration is generally advisable.
8. From the standpoint of slowness of growth and rarity of metastasis, surgical treatment should be favorable.

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9. Early treatment of disease of the gall-bladder may occasionally prevent the development of malignancy.

10. Operation on patients with jaundice carries a high mortality.

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PERFORATION OF DUODENAL ULCER FOLLOWING GASTRO-ENTEROSTOMY

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THE occurrence of perforation of peptic ulcers following gastro-enterostomy is an accident of sufficient rarity to be reported. Such perforation is relatively less common than accidental post-operative hemorrhage following gastro-enterostomy or hemorrhage due to the erosion of a large blood-vessel.

It is well known that peptic ulcers may continue to exist, or even progress, following gastro-enterostomy with or without exclusion of the pylorus or inversion of the ulcer. Hemorrhage from continued activity of an ulcer following gastro-enterostomy without perforation is relatively frequent.

The total number of cases of perforation following gastro-enterostomy, which have been found after a careful search of the literature, numbers twenty-nine cases. In twenty-eight of these cases death followed from hemorrhage or peritonitis. In fifteen cases a posterior gastro-enterostomy was done and in four cases anterior gastro-enterostomy. In eleven cases the perforation followed a simple posterior gastro-enterostomy. In four cases the perforation followed a posterior gastro-enterostomy plus pyloric exclusion. Ten cases presented perforation following operative procedures which are not given in detail in the reports.

Of the twenty-nine cases reported in the literature the location of the ulcer in nineteen was in the duodenum. In eight cases the ulcer was in the stomach. In the remaining two cases the location of the ulcer is not definitely stated. The close relationship between post-operative gastro-intestinal perforations and the occurrence of hemorrhage requires these two accidental conditions to be considered together. In thirteen of the fatal perforations it is stated that death was due to hemorrhage, while in fourteen cases death is ascribed to peritonitis. In the two cases reported by von Eiselsberg, the immediate cause of death is not clear. In one of these cases the cause of death is given as progressive extension of the ulcer and in the other case the cause is given as perforation, without detail.

In four of the twenty-nine cases it is stated that the gastro-duodenal or the pancreaticoduodenal artery was eroded following the gastro-enterostomy. Thompson⁸ states that the gastro-duodenal artery is more likely to be involved than any other vessel owing to its anatomical relationship with the first part of the duodenum. Deep eroding ulcers occupying the posterior wall are pretty sure to extend to this vessel sooner or later and there may be severe hemorrhage if the extension of the disease is sufficiently marked.

It seems to be proven fairly well from experience in many cases that gastro-enterostomy as an operative procedure, in itself, checks hemorrhage

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from duodenal ulcers. However, the large number of cases in which this result has not occurred should suffice to put surgeons on their guard not to trust absolutely to the operation of gastro-enterostomy with or without exclusion to stop hemorrhage or perforation, even after the infolding of the ulcer, as occurred in our own case.

CASE.—The case which it is desired to report here is as follows: A. C. M., age forty; male; American; physician; was admitted to St. Vincent's Hospital, September 27, 1921. Operated September 28th, with death October 4, 1921. Pre-operative history: While in service in France had an acute attack of pain in the abdomen; was sent to the hospital with a diagnosis of acute appendicitis. Operation was not performed at this time. The patient was able to return to duty in ten days, but occasionally had distress after meals—this would clear up and he was relieved for several months. For past six or eight months he would eat between meals and this relieved his distress; occasionally he would get up at night and drink milk or eat a cracker. There was no acute pain or blood in stool.

There was nothing in the present condition indicating that the ulcer was about to perforate. Operation was done under ether anaesthesia during which a posterior gastro-enterostomy, without loop, and also a routine appendectomy through an upper right rectus incision. The ulcer was found on the anterior wall of the duodenum about one-half inch from the pylorus. The base of the ulcer was found to be indurated without any evidence of perforation. The ulcer base was folded in with interrupted linen and then covered by an omental graft. The usual posterior gastro-enterostomy was done, excepting that owing to the thickness of the abdominal wall I was unable to use a clamp on the stomach. The catgut sutures in the anastomosis were reinforced with interrupted linen.

The gall-bladder was found to empty freely and to contain no stones. No enlarged glands were found along the ducts. The abdomen was closed in the ordinary manner. Following the operation the temperature and pulse remained normal during the first twenty-four hours. The patient complained of being thirsty and showed the usual post-operative discomfort. The abdomen was not distended. On the day following, September 29th, the patient complained of severe thirst and also moderate vomiting. There was slight distention but no pain. The next day, September 30th, the condition of the patient seemed to be considerably improved. There was moderate abdominal distress, but the patient had slept most of the night; the pulse was of good volume. On October 1st he complained of severe gas pains in lower abdomen attended with marked restlessness. Patient did not sleep well, although the pulse remained good. The next day the abdominal distention was more marked, with an increase in the restlessness and nervousness of the patient. His condition was more serious the day following with rapid respiration, weak pulse, subnormal temperature, and death occurred at 5 A.M. October 4, 1921.

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Following Gastro-enterostomy

Case No.	Reporter and Reference	Pathology	Operation	Post-operative Complications	Result	Remarks
1	Eve. Lancet, London, 1908, i, 1822.	Duodenal ulcer.	Anterior G. E. because the stomach was bound down by posterior adhesions.	Patient died 40 days later.	Autopsy showed an ulcer on inner surface of duodenum with ragged base extending deeply into pancreas.	Death due to uncontrollable malena.
2	Petren, Beitr. z. klin. Chir. 1911, lxxvi, 305.	Case 2, p. 336, of this series, operated for gastric hemorrhage.	Posterior retrocolic G. E.	Hemorrhage 3rd day. Death 5th day.	Autopsy showed the defect in the mucous coat with small eroded vessel.	Death due to hemorrhage.
3	Petren, Beitr. z. klin. Chir. 1911, lxxvi, 305.	Case 3, p. 336, of this series, operated for gastric hemorrhage.	Retrocolic posterior G. E. and enteroanastomosis.	Death on 4th day.	Autopsy showed organs anemic and small perforated ulcer on curv. min. near cardia.	Death due to hemorrhage.
4	Petren, Beitr. z. klin. Chir. 1911, lxxvi, 305.	Case 1, p. 336, of this series, operated for severe gastric hemorrhage.	Retrocolic posterior G. E.	Death 2 days later. Perforated duodenal ulcer near pylorus, the perforation being clear through to the pancreas.	Verified by autopsy.	Ulcer size of 2 mark piece. Due to hemorrhage.
5	Petren	Case 7, p. 337, of this series, situation of ulcer not stated.	G. E.	Bloody vomiting evening and night after operation with bright red blood. Relaparotomy 2nd day with gastrostomy.	Date of death not stated.	Further particulars not given. Death due to hemorrhage.
6	Petren	Case 7, p. 338, of this series, ulcerus ventriculi.	Retrocolic posterior G. E.	Blood in stool 5th day and later. On 12th post-op. day sudden high grade anemia. Died 5 days later.	Autopsy showed perforated ulcer on posterior face of stomach. The art. lienalis was eroded.	Death due to hemorrhage.
7	Petren, Beitr. z. klin. Chir. 1911, lxxvi.	Case 3, p. 332, of this series, ulcerus ventriculi.	Anterior antecolic G. E. with enteroanastomosis.	Symptoms of perforation peritonitis on 5th day. New laparotomy and drainage 18 days after G. E.	Died the day following reoperation. Autopsy showed perforated ulcer in the posterior wall of stomach.	Death due to peritonitis. The perforation appears due to retraction of the shortened curve.
8	Petren	Case 8, p. 338, of this series, pyloric ulcer tumor.	Antecolic anterior G. E.	Voluminous bloody vomiting on 4th day. Death on 5th day.	No further particulars given.	Death due to hemorrhage.
9	Petren	Case 8, p. 333, of this series. Situation of ulcer not stated.	Retrocolic posterior G. E.	Death after 6 days.	Autopsy showed a small perforation in the G. E. loop.	Death due to hemorrhage.
10	Petren, Beitr. z. klin. Chir. 1911, lxxvi, 319.	Case 15, p. 331, of this series. Operated for ulcerus ventriculi and chronic gastritis.	Retrocolic posterior G. E.	Stomach and liver adherent at site of tumor. Left hospital feeling well. Returned later with symptoms of peritonitis. Relaparotomized.	Small perforation found in the stomach wall in the site of the adhesions between the stomach and liver and parietal peritoneum.	Patient made a good recovery.
11	Pelissier, Bull. Soc. Anat. de Paris, 1912.	Pyloric stenosis with ulcer. Pyloric region blocked by adhesions.	G. E.	Patient died suddenly 3rd day after operation.	The death was due to peritonitis.	Autopsy showed a perforation on anterior face of first portion of duodenum running into scar tissue blocking pylorus. Operative rupture of adhesions to inferior face of gallbladder had caused peritonitis.

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Case No.	Reporter and Reference	Pathology	Operation	Post-operative Complications	Result	Remarks
12	Thompson, Annals of Surgery, 1912, lvii, 695.	Duodenal ulcer posterior wall, blood in stools for 6 months previous.	Posterior G. E. ulcer not infolded.	Died 34 hours after operation symptoms of internal hemorrhage.		No autopsy. Author surmises from the position of the ulcer that gastro-duodenal artery eroded.
13	Thompson	Duodenal ulcer; posterior wall, worms in stools for 6 months previous.	Posterior G. E. ulcer not infolded.	Died with symptoms of hemorrhage 42 hours after operation.	Autopsy showed that the ulcer had perforated post-operatively.	The hemorrhage came from the eroded gastro-duodenal artery.
14	Mayo-Robson, Lancet, Lond., Feb. 9, 1901, 378.	Hemorrhage supposed to be from a gastric ulcer.	Anterior G. E. with Murphy button.	Severe abdominal pain on 6th day; patient died 10 days after operation from perforation at site of the anastomosis.	Death was due to peritonitis due to leakage when the button began to separate.	Autopsy gave no evidence of gastric ulcer, but there was large deep duodenal ulcer at bottom of which gastro-duodenal artery was found with an ulcerated hole in its side completely closed by a firm thrombus.
15	Horak, Zentralbl. f. Chir., 1921, xli, 1088.	Duodenal ulcer.	Posterior Hacker-Hochenegg G. E. without pyloric exclusion.	Perforation of ulcer 3 days after operation.	Death	
16	Kaspar, Deut. Zeitsch. f. Chir., 1914, cxxxi, 531.	Case 9, p. 578, of this series, hemorrhagic ulcer duodeni.	Retrocolic posterior G. E. with exclusion.	Severe vomiting following day. Relaparotomized.	Death	
17	Kaspar, Deut. Zeitsch. f. Chir., 1914, cxxxi, 531.	Case 2, p. 576, of this series. Stenosing transpyloric duodenal ulcer.	Patient's state did not admit of radical operation. Simple G. E. only.	Death 3 days later. Perforation of duodenal ulcer in the anterior wall.	Findings at autopsy.	It is probable that ulcer had perforated before operation, but was not recognized at time of operation.
18	Kaspar, Deut. Zeitsch. f. Chir., 1914, cxxxi, 531.	Case 38, of this series, ulcer ventriculi, or ulcer duodeni with hemorrhage.	Retrocolic posterior G. E.; pylorus ligatured; ligature of art. pancr. duod.	Death 9 hours later.	Autopsy showed chronic ulcer of pars horizont. duod. Erosion of large branch of the truncus coeliacus.	
19	Le Roy des Barris, J. de chir., Paris, 1913, xi, 479.	Case diagnosed as gastric ulcer; found to be inextirpable ulcer of duodenum pyloric region.	Posterior G. E. pylorus not excluded.	Vivid pains 4th day after operation. Died 13 days after operation.	Autopsy showed no peritoneal reaction; large amount of effused blood in all intestine. Ulcer was in posterior face of pyloric region and at its site a large patch of intestine had disappeared.	Death was due to perforation of the portal vein by progress of the ulcer despite the G. E.
20	Horwitz Arch. f. klin. Chir., 1917-18, cix, 567.	Case 11 of this series. Ulcer duodeni.	G. E.	Vomitus bloody the day after operation. Treated by lavage, salt infusion, etc. Patient very weak. Died.	Autopsy showed fluid blood from small perforation in posterior wall of duodenum. G. E. edges also hemorrhagic and a bleeding polyp found there.	
21	Vulliet Rev. med. de la Suisse rom., 1918, xxxiii, 688.	Case 6, of this series. Pyloric stenosis.	Retrocolic posterior G. E. without any loop.	Patient reoperated for complication on 6th day. Anterior button G. E. simple. Patient died 7 days later.	Autopsy showed that traction of anastomosed loop caused a large tear in the serosa and exposed the button.	Perforation probably occurred intra vitam.

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Following Gastro-enterostomy

Case No.	Reporter and Reference	Pathology	Operation	Post-operative Complications	Result	Remarks
22	Carr J. Am. M. Assn., 1919, lxxiii, 34.	Pyloric ulcer. Ulcer on anterior side of pylorus with no suggestion of impending perforation.	Posterior G. E. (low) and appendicectomy.	Vomiting, etc. on 6th day. Died 7th day.	Autopsy showed that the induration about the ulcer had subsided and its base was perforated. Perforation had the diameter of a lead pencil.	Died from peritonitis.
23	Troell, Deut. Zeitschr. f. Chir., 1919, cxlviii, 404, cxlix, 1.	Case 26 of this series. Ulcer of duodenum; adhesions and hardening of the horizontal part of the duodenum found at operation, but which did not suggest ulcer.	Palliative G. E. and partial pyloric exclusion.	Ulcer perforated 20 hours after the operation and the patient died.	Autopsy showed that death was due to perforation peritonitis.	Author says that all adhesions should be cleared when making the operation, as they are deceptive.
24	Hohlbaum, Arch. f. klin. Chir. 1919-20, cxiii, 499.	Case 1, of this series, chronic duodenal ulcer; ulcer at operation found on posterior part of the duodenum; the anterior wall was succulent.	Posterior G. E. with pyloric exclusion.	Perforation of ulcer the day after operation. Patient died.	Autopsy showed that the ulcer in the anterior wall had perforated.	Death due to peritonitis.
25	Hohlbaum, Arch. f. klin. Chir. 1919-20, cxiii, 499.	Case 2, of this series, chronic duodenal ulcer.	Simple G. E.	Perforation of ulcer of duodenum the day after operation. Patient died.	Perforation of ulcer on anterior wall of duodenum verified at autopsy.	Death due to peritonitis.
26	Finochietto, Semana Med., 1918, xxv, 699.	Case 62, of this series. At operation hard tumor found at pylorus adherent to pancreas.	Usual G. E.	Patient reoperated 9th day for complications. Death 12 days later.	Autopsy showed 2 ulcers on the posterior face of the first portion of duodenum, one of which 2 cms. in diameter had perforated into the pancreas.	Death due to peritonitis.
27	Finochietto, id.	Case 37, of this series. Operation: ulcer of small curvature of stomach and pylorus and adherent to inferior part of liver.	G. E.	Severe hematemesis on 5th day. Symptoms of acute anemia and death.	Autopsy showed ulcer situated posterior face of the first part of duodenum. The gastro-duodenal artery was found in its fundus ruptured.	Death due to hemorrhage.
28	v. Eiselsberg, Surg. Gyn. and Obst., 1912, xix, 555.	Out of 334 gastro-enterostomies of stomach for duodenal ulcer there were six immediate post-operative deaths due to hemorrhage from an ulcer; also one death from progressive extension of the ulcer. In the later results six died from extension of the disease, one case of which was a perforation.				
29	Sherrin, Surg., Gyn. and Obst., 1914, 567.	In 78 cases of gastro-jejunostomy for gastric ulcer without excision, two cases had to be operated again "which had perforated and were adherent to the pancreas." Both recovered. Treats chronic duodenal ulcer by infolding the ulcer when on the anterior wall and posterior gastro-jejunostomy.				

Post-mortem showed a well-developed adult male, apparent age forty, very little post-mortem discoloration. Chest and abdomen opened through median incision. There was a thick layer of subcutaneous fat over the abdomen. The body had been previously embalmed and the gut

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punctured with leakage of the intestinal contents within the abdominal cavity. The small intestine presented evidences of slight inflammation. Examination of the gastro-enterostomy wound revealed no evidence of leakage or obstruction of the opening. There were three deep ulcers in the duodenum. One ulcer was of the perforating type with destruction of the entire mucosa in the ulcer crater. One ulcer had perforated through the peritoneal coat with discharge of duodenal contents along the sutured area where an attempt had been made to cover over the ulcer base during the operation. The liver was small and there was evidence of fatty degeneration. Both kidneys were small and there was chronic interstitial nephritis. The spleen, pancreas, lungs, heart were found to be normal.

Larrien, in a recent article published in 1921, states that he has been able to collect eighty-one cases in which there was perforation of the ulcer following the operation over a prolonged period of time. However, we are concerned in this particular study more particularly with cases which have perforated immediately following the operation and in this type of cases the number found by Larrien is only twenty-eight. Larrien thinks that post-anæsthetic vomiting and stomach lavage done without due precaution favor perforation. The nature of the ulcer is also a factor. In certain instances the perforation has occurred prior to the operation but is walled off by adhesions. Another cause of perforation is traceable to the defective functioning of the enterostomy. As a general rule, when the gastro-enterostomy functionates well, the ulcer cicatrizes rapidly, and, in a contrary way, if the opening is not working satisfactorily, the ulcer persists in an active stage.

Diagnosis.—When the symptoms of perforation follow soon after operation, they may be confused with "circulus virtiosus" or with post-operative dilatation of the stomach. A distinction must also be made from peritonitis developing from causes other than perforation. The diagnosis may be made with great difficulty inasmuch as the symptoms are masked more or less by the symptoms following operation, such as abdominal pain, increased pulse-rate, and increased temperature. The occurrence of sharp pain appearing without premonitory signs in a patient otherwise doing well, should make one very suspicious of a perforation. Stress should be laid upon the appearance of symptoms of an abrupt nature appearing in the case of a patient otherwise doing well. When the ulcer has been infolded and the perforation does not permit the contents of the gastro-intestinal canal to reach the peritoneal cavity suddenly, the symptoms may be delayed and render the diagnosis exceedingly difficult, if not impossible.

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LYMPHOSARCOMA OF THE INTESTINE

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LYMPHOSARCOMA of the intestinal tract is a fairly rare condition, and the literature on this subject presents a confusing picture in which the microscopic details are obscure. The condition may occur in any portion of the alimentary tract, the seats of election being the stomach, lower ileum, and rectum. Lymphosarcoma of the intestine is much less frequent than carcinoma. The relation of these two tumors is about one to twenty. Lymphosarcoma may involve either the small or large intestine, while carcinoma is far more frequently found in the large intestine and rectum.

Krugerz Boas,¹ who collected reports of thirty-seven cases of sarcoma of the intestine, found the small intestine involved sixteen times, the ileocæcum once, the cæcum twice, the vermiform appendix once, the transverse colon once, both the small and large intestine once, and the rectum sixteen times. Smoler² states that there occurs one case of sarcoma of the small intestine in every thousand autopsies; he found thirteen cases in 13,036 autopsies. The distinction between round-cell sarcoma and lymphosarcoma was apparently made very seldom.

During the last twelve months in the Department of Pathology of the Albany Hospital two cases of lymphosarcoma of the small intestine were encountered, a description of which constitutes the basis of this paper.

I wish to express my thanks to Dr. A. W. Elting and Dr. J. A. Sampson for the use of the clinical facts associated with the cases and to Dr. V. C. Jacobson for the assistance he gave me in the preparation of the pathological material.

CASE I.—H. S., male, Jew, aged twenty-six years, chauffeur. He entered the Albany Hospital, February 11, 1921. His chief complaint was loss of appetite and gastric distress after eating. His family history is negative. He had always been in good health. Measles was the only sickness he remembers having had when a child. His bowels were regular before his present illness. His trouble dated back to November, 1920, when he began having sharp pains in the epigastrium following eating. He belched considerably and was nauseated, but he never vomited. Meat seemed to cause the most distress and this lasted one-half to one hour after eating and was not relieved by taking food. His appetite diminished and his

* Dr. DeNoyelles died May 23, 1922. He was a very conscientious worker in surgical pathology and this study of intestinal lymphosarcoma by him is most creditable, particularly in view of the fact that he was a constant sufferer from nephritis while engaged in its preparation. His premature death cut short what gave evidence of being a highly successful professional and scientific career. (V. C. Jacobson.)

condition gradually became worse. His average weight was 147 pounds, on February 14th it was 145 pounds.

Physical Examination.—In general the patient's condition seemed good. The pupils reacted to light and accommodation. The heart and lungs were normal. There were bilateral palpable inguinal lymph-glands. Except for the abdomen, the physical examination was entirely negative. His abdomen was very muscular and rigid throughout. When he flexed his thighs a mass was visible in the upper right umbilical region. It moved with respiration, followed the movement of the diaphragm. Pressure over mass caused some spasm and referred pain in the epigastrium. The most tender point was over the border of the right rectus muscle, midway between the umbilicus and the margin of the ribs. On palpation the mass seemed superficial, firm and smooth. By pressing forward with one hand in the costo-vertebral space, the mass was more readily palpable. Pulse, temperature



FIG. 1.—Drawing of the tumor in Case I.

and respirations were normal. Systolic blood-pressure was 128; diastolic 80. The blood Wassermann reaction was negative. The blood examination showed hæmoglobin eighty per cent. (Sahli); white cells 12,000. The urine was amber, slightly cloudy; specific gravity, 1.016, acid, and contained a slight trace of albumin. The sediment consisted of mucous shreds, a few pus cells, and a rare shadow of a red blood-cell. A stool gave a strongly positive reaction for occult blood. Röntgen report; a barium meal showed the œsophagus normal, the stomach high in position and of the modified 'steer-horn' type; no filling defects, incisura or notches. The pylorus seemed smaller than usual and gave the impression that it was pushed up or pulled up into its present position. The cap was smooth and regular in outline. The barium enema revealed nothing abnormal except for an abnormally high position of the transverse colon. The urinary and biliary tracts were negative upon X-ray examination.

Course of the Disease.—The patient left the hospital on February 16, 1921, and on February 24, 1921, he returned, his condition having become worse, and his appetite very poor. He felt weaker and was extremely constipated. His weight was 139 pounds. Hæmoglobin seventy per cent. The stools were again strongly positive for occult blood. He was told an exploratory operation was necessary. Operation,

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March 4, 1921, revealed a tumor of the jejunum about sixteen inches from the ligament of Treitz. This tumor encircled the jejunum, being about five inches in length and three inches in diameter. Below it the lymph-glands were as large as English walnuts and extensively involved, some being a considerable distance from the intestinal tumor. The extremities of this tumor were rather sharply defined. The tumor was adherent to the omentum and transverse colon. The intestine containing the mass was resected and a lateral anastomosis done. Radium was placed in the region of the mesenteric gland involvement, the usual precautions being taken. The patient expired March 7, 1921. Permission for necropsy could not be obtained.

Pathological Examination.—The specimen consists of a loop of small intestine with a kidney shaped annular tumor mass involving practically all of it. The tumor measures 11.5 cms. in length, 8 cms. in diameter, and weighs 330 grams.



FIG. 2.—Drawing of the tumor in Figure 1, opened by a longitudinal incision. The narrowing of the lumen of the gut is shown. The mucosa is practically entirely destroyed by the tumor which infiltrates the entire wall.

The serosa has many tags attached to it. There are also many dilated blood-vessels in the serosa. The tumor is uniformly firm with a few groove-like depressions on its surface. A longitudinal incision shows the wall to be firm and varying in thickness from 1.5 to 3 cms. It is translucent and grayish pink, all the layers of the intestinal wall seem to be paced by this tumor mass. A lumen is present throughout, varying in diameter from two to three centimeters. The mucosa is ulcerated and covered in places by tarry semi-solid material (Figures 1 and 2).

Microscopical Examination.—Tissue was fixed in ten per cent. formalin-alcohol and embedded in paraffin. Sections were stained with hæmatoxylin and eosin. A study of the sections discloses the following facts.

The tumor consists of a diffuse growth of lymphoid cells lying in a coarse reticulum. The intestinal wall is almost entirely replaced by tumor cells with the exception of a few glands that are still present. The cells of the tumor vary much in size. There are areas of small cells, hyperchromatic with dense nuclei of the

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lymphocyte type. However, most of the cells are fairly large with somewhat vesicular nuclei. Two nuclei are present in many large cells. Many of the nuclei are lobulated, and mitotic figures are numerous. Many of the cells of the tumor resemble quite closely the transitional cell of the blood or clasmatocyte (Sabin). The smaller cells appear to be lymphocytes of various sizes, many in mitosis.

CASE II.—Mrs. P. H. K., American, age thirty-nine, housewife, entered the Albany Hospital, October 4, 1921. Her chief complaint was pain in the abdomen, considerable belching of gas, nausea and vomiting. Her family history was negative. She had had no children, and no miscarriages. Her menstrual periods were regular, normal in amount and duration. Her general health had been good. She had had pneumonia in 1917. She had been somewhat constipated for many

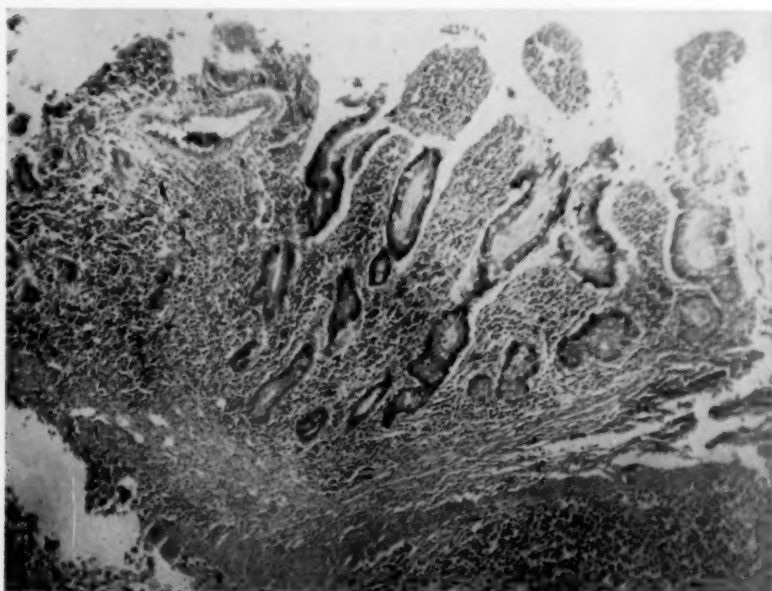


FIG. 3.—A low-power photomicrograph of the tumor in Case I showing the infiltration of the intestine wall by tumor cells.

years. The onset of her present illness was in April, 1921, with severe pain in the epigastrium, nausea and vomiting. This attack lasted four days. Four to five weeks later a similar attack occurred. Pain came on independent of the taking of food and not relieved by food. She belched large amounts of gas. The pain now radiated toward the symphysis pubis.

Physical Examination.—Except for the abdomen the physical examination was essentially negative. The point of maximal tenderness was in the region of the gall-bladder. There was moderate spasm of the right rectus muscle in this region. There was no palpable mass in the abdomen. Pulse, respirations and temperature were normal.

Clinical Pathology: Urine: amber, cloudy, slightly acid; specific gravity, 1.017, negative for albumin and sugar. The sediment contained a few clumps of pus cells, mucous shreds and squamous epithelial cells. Phenolsulphonephthalein elimination was fifty per cent. in two hours.

Röntgen report: The urinary tract was negative for stones. Both kidneys were visible and were apparently normal in size. There was a shadow in the

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region of the gall-bladder, probably due to a thickened gall-bladder wall or stone. The large bowel filled normally, and there were no constrictions or filling defects. The œsophagus was normal, stomach of the 'steer-horn' tonic type, high in position. The outline of the stomach and cap were normal. In six hours time there was a small amount of barium residue in the stomach. The barium was also in the coils of the small intestine. None of the meal had reached the cæcum. In twenty-four hours time the large bowel was apparently negative.

Course of the Disease.—After the gastro-intestinal X-ray examination, the symptoms rather suddenly changed and then presented as a case of complete intestinal obstruction. There were obstipation, vomiting of intestinal contents, and general toxic symptoms. Hence an exploratory laparotomy was emphatically advised.

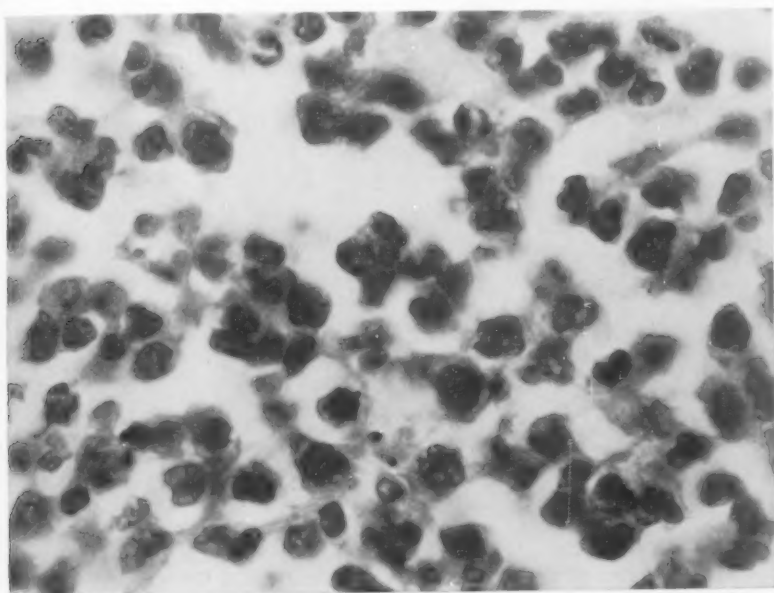


FIG. 4.—An oil-immersion photomicrograph of a field of the tumor in Case I. Several mitotic figures are present. The cells are of practically the same type as in Case II, the formalin fixation being responsible for much shrinkage of the cytoplasm.

Patient was operated on October 8, 1921, under ether anæsthesia and a tumor of the ileum was found about twelve inches proximal to the ileocæcal junction. A loop of the ileum about sixteen inches in length with its corresponding mesentery was resected and a lateral anastomosis of the two ends of the ileum was done. An appendicectomy was also performed. Drainage was instituted. The patient made an uneventful recovery and was discharged from the hospital November 13, 1921. Up to March, 1922, she had had no symptoms of recurrence.

Pathological Examination.—The specimen consists of a loop of ileum with part of its mesenteric attachment. It is about forty centimetres in length, six centimetres in diameter at its widest portion, and weighs 410 gms. The middle third of the loop is dilated, this portion measuring about ten centimetres in length, very firm and appears to contain a mass, probably invaginated gut. There are a few fibrous tags attached to the serosa at the beginning of the invagination. Embedded in the mesenteric fat are a few rather firm lymph-nodes, none larger than 0.5 cm. in diameter. A longitudinal incision of the intestine shows the

enlargement of the bowel to be caused in part by an invagination of a proximal into a distal portion of the ileum. The resulting intussusception is irreducible, organization apparently having occurred between the approximating serous surfaces. At the summit of the intussusceptum there is a polypoid mass which is rather friable. It is four centimetres in length and $2\frac{1}{2}$ centimetres at its base and grayish pink. The polypoid growth occupies nearly the entire lumen, a patency of only 0.3 cm. remaining. The muscular layers of the intestine proximal to the intussusceptum are hypertrophied to about twice the thickness of the intussusciens.

Microscopical Examination.—Tissue was fixed in Zenker's fluid and ten per cent. formalin. Sections were stained with hæmatoxylin and eosin, phosphotungstic acid-hæmatoxylin and Mallory's aniline blue. The tissue was taken from the polypoid tumor mass and the adjacent intestinal wall.



FIG. 5.—A gross photograph of the specimen from Case II. The polypoid tumor has been opened by a longitudinal incision to show the actual size of the tumor and the extent of the intussusception.

The tumor is composed of broad tracts and narrow cords of polyhedral cells which vary much in size but are as a whole about twice the size of the cells in Case I, about 20 micra. These cells lie irregularly distributed in the tissue spaces and narrow fibrovascular septa constitute the stroma. The cells contain a liberal amount of cytoplasm but the nuclei are also large, often $\frac{2}{3}$ the size of the cell, and usually lobulated or horseshoe shaped. The nucleoli are very sharply staining and one or two are presented in each nucleus. Numerous mitotic figures are present. There are many multinucleated giant cells and also some polymorphonuclear leucocytes in the outer layers of the tumor. Fibrin thrombi are present in some of the capillaries. There is no epithelial tissue covering the tumor except toward its base. The mesenteric lymph-nodes show chronic lymphadenitis but no malignancy.

Discussion.—In the first case a great many preoperative diagnoses were considered. The fact that the patient appeared so well at first, the elusiveness of the tumor mass, and especially the negative X-ray examination, made most

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observers hesitate at making a positive statement concerning his condition. There are, however, certain important features in this case, some developing definitely while in the hospital, and which demanded surgical investigation, the impression gaining weight that malignancy of the bowel existed. The symptoms of partial obstruction were almost constantly present, such as the colicky pain, belching of much gas, nausea, vomiting, constipation and repeated findings of occult blood in the stools, also an elusive although ever-present tumor mass in the abdomen.

The second case presents a still more complex picture enhanced perhaps by the region to which the findings pointed. The physical and X-ray examinations suggesting gall-bladder disease and the absence of any palpable tumor gave little aid in determining the condition present. Here again the symp-

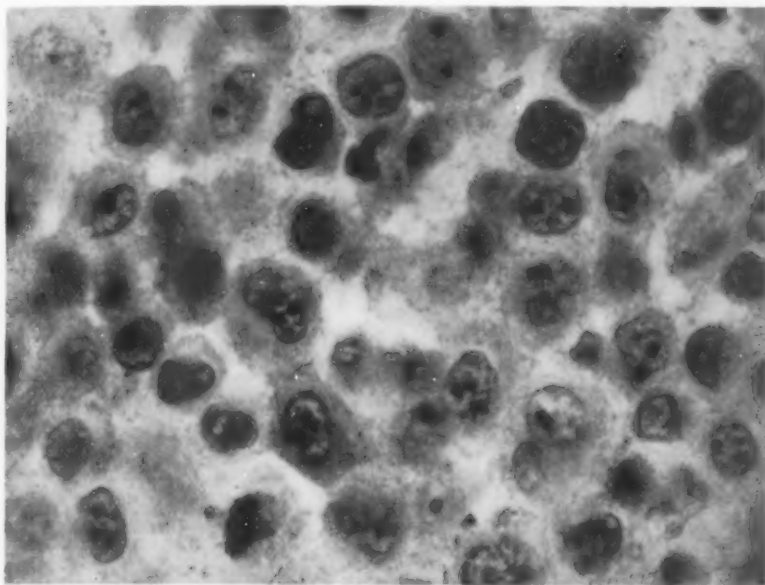


FIG. 6.—An oil-immersion photomicrograph of a field of the tumor in Case II. A mitotic spindle is present in one cell. The character of the nucleus and cytoplasm in these cells is well brought out.

toms of intestinal obstruction led to the advisability of surgery. In this case there was undoubtedly present a chronic intussusception as indicated by the organization found between the serous surfaces of the polyp and adjacent gut. Acute obstruction is very prone to develop in these cases, the active catharsis invariably employed possibly being a factor. Tumors of the intestine are a comparatively frequent cause of intussusception in adults, but occur rarely in infants and children. Of 300 cases cited by Eliot and Corscaden,³ there were sixty instances of benign tumor type. In almost every case the tumor occupied the apex of the invaginated portion of the gut. By far the most frequent are cases in which the intussusception is preceded by symptoms referable more directly to a malignant stricture.

In both cases the X-ray findings were of little help, the inability to make a positive X-ray diagnosis being due in part to the partial patency of the intestines and also to the absence of any examination of the barium contents of the intestine at the time when it was most probably obstructed by the tumor. It has been suggested by Howard⁴ with this last point in mind that X-ray examinations at periods of one to two hours in such cases would help in determining a temporary retardation of the progress of the barium meal.

The diagnosis of lymphosarcoma is rarely made clinically, as the condition is so infrequently met with in the intestine. Ochsner⁵ describes the early symptoms as being indefinite abdominal pain, persistent and unrelieved by rest and starvation, colicky and not particularly well localized, often associated with anæmia and cachexia. Like carcinoma, it is often the constitutional effect of the growth that is first noticed, the local signs remaining in the background for a considerable time. There are no certain means of distinguishing between carcinoma of the intestine and lymphosarcoma. Stenosis of the bowel is rare in the latter condition and such occurred in the first case. The obstruction symptoms are due to pressure of the tumor itself or of the involved mesenteric nodes upon the adjacent coils of intestine.

The treatment is removal of the growth, the section in which it originates and any accessible metastases. This procedure may entail the removal of a very considerable length of intestine and it is often a question of judgment whether it should be attempted or not. With the extent of the involvement in the first case, the advisability of surgery might be questioned. However, without radical operation, death would certainly and speedily have come.

The application of radium may prove to be a valuable palliative procedure in these cases. Lymphosarcoma in other regions of the body is to some extent amenable to radiation. If radium exerts a beneficent influence in such regions, it might be used in the post-operative treatment of lymphosarcoma of the alimentary tract, but the difficulty of making a preoperative diagnosis and the development of a suitable technic of application will long be serious obstacles. Bloodgood⁶ says: "The one lesion of which, as far as I know, surgery has never accomplished a cure, is lymphosarcoma of the lymph-glands, and apparently radium has done so. Therefore, as soon as this diagnosis is suggested and established, radiation should be given, and continued at intervals." This statement offers more relief to the patient than most experience leads one to expect, and the difficulty of barring radium rays from such vital tissues as the adrenals will probably long be a great drawback to intra-abdominal radiotherapy.

Lymphosarcoma of the alimentary tract probably arises as a rule from the lymphoid cells of the mucosa, but there are many types of these cells in the small intestine. Bunting and Huston⁷ showed that the lymphocytes in the blood stream migrate into the mucous membrane of the gastro-intestinal tract, and apparently there, and in the intestinal lumen, the function of the lympho-

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cyte is normally performed. Jacobson⁸ has suggested that the lymphoid cells which are very capricious and unstable may in response to some irritant, possibly infectious, acting over a considerable period or in a specific manner, be influenced to a lawless proliferation. It is often difficult to make a distinction between lymphosarcoma of the gastro-intestinal tract and some of the infectious granulomata found there.

In the tumors upon which this study is based the predominant cell is one of the size of the transitional leucocyte of the blood and with a lobulated or horseshoe-shaped nucleus. The other cells were large and small lymphocytes and eosinophiles.

CONCLUSIONS

1. Two cases of lymphosarcoma of the intestine are described, one of tumor of the jejunum, the other of the ileum. In one instance the tumor was a diffuse infiltration of the intestinal wall, an annular type of growth. In the other case a lymphosarcomatous polyp was found which gave rise to an intussusception.

2. The microscopic picture leaves much speculation as to the origin of the tumor cell, but in these two cases the predominant cell is one which resembles a great deal the transitional large mononuclear cell of the blood.

3. Lymphosarcoma of the intestinal tract is difficult of clinical diagnosis, the signs being simply those of malignancy, with partial obstruction being rather constantly present. X-ray examination was of no help in these two cases.

4. Treatment consists of radical removal of the primary growth with as much of the metastases as is possible. Improved methods of radium application might be a valuable therapeutic adjunct.

5. Chronic irritation, possibly a specific toxin, may play an important rôle in the genesis of lymphosarcoma. The histology of infectious granulomata of the intestine often simulates this tumor. Perhaps lymphosarcoma is only one of the many bizarre late pictures of lesions which were at one time of the nature of Hodgkin's disease or lymphoblastic or lymphocytic aleukæmia.

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METAPLASIA IN OVARIAN DERMOIDS AND CYSTADENOMAS

REPORT OF THREE CASES

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THE relation of metaplasia to neoplastic pathology was studied and discussed by Lubarsch, in 1901, and he mentioned several examples, among them a squamous-cell epithelioma of the gall-bladder. He asserted that there is no squamous epithelium in the gall-bladder, bile ducts, or neighboring structures and concluded that such an epithelioma probably results from

metaplasia of the lining cells of the organ. Two of the three cases herein reported are typical of metaplasia in ovarian dermoid cysts and one is a papillary cystadenoma.

CASE I (A8536).

—Mrs. C. E., aged fifty-eight years, a widow, and the mother of four children, was examined in the Clinic, April 6, 1908. She complained of a small "lump" in the left side of the abdomen accompanied by a "burning and drawing sensation" of five months' duration.

Four months before there had been blood in the stool. In the last few months she had felt weak, lost fifteen pounds in weight, had increasing constipation, and noticed a gradual enlargement in girth. Fourteen months before, a cyst of the right ovary had been removed elsewhere and the pathologist had reported it to be a dermoid cyst with beginning malignancy.

Dr. W. J. Mayo resected the sigmoid which was involved by a malignant neoplasm; the tumor consisted of a papillary epithelioma

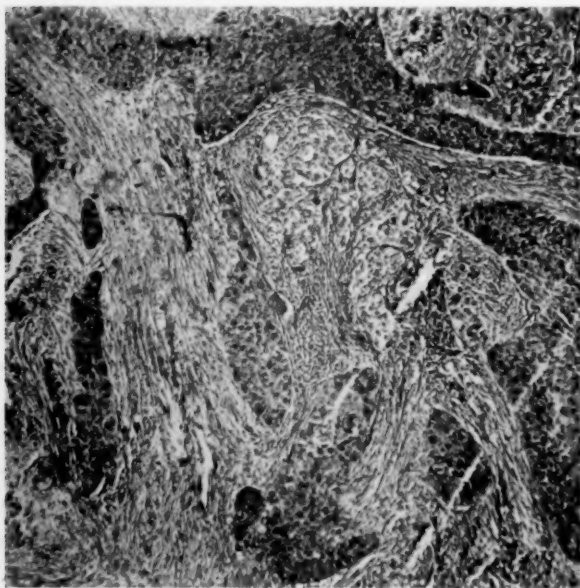


FIG. 1.—Epithelioma. In certain areas the cells are not differentiated and show evidence of rapid growth (X50).

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(Figs. 1 and 2) which had apparently arisen from the dermoid cyst previously removed and had involved the sigmoid secondarily. The patient died about nine months after the last operation.

CASE II (A380815).—Mrs. B. H., aged sixty-seven years, the mother of six children, came to the Clinic January 3, 1922, complaining of a gradually increasing swelling of the abdomen. Following the appearance of the tumor she had had a burning pain in the right lower abdominal quadrant. Her health had been only fair for eight or ten years. Headaches, abdominal heaviness, and belching following meals distressed her greatly.

At examination a large, hard abdominal tumor was found, which extended to about 4.5 cm. above the umbilicus.

At operation Dr. E. S. Judd found a large cyst of the right ovary filling the pelvis and much of the peritoneal cavity. The uterus, left tube, and ovary were grossly unaltered and were not disturbed. A large dermoid cyst, weighing 4800 gm. and containing sebaceous material and hair, was removed. On the inside of the cyst was a grayish-brown papillary mass, 4 cm. in diameter, projecting into the cavity from 1 to 3 cm. (Fig. 3). Microscopically the growth was a papillary squamous-cell epithelioma (Figs. 4 and 5).

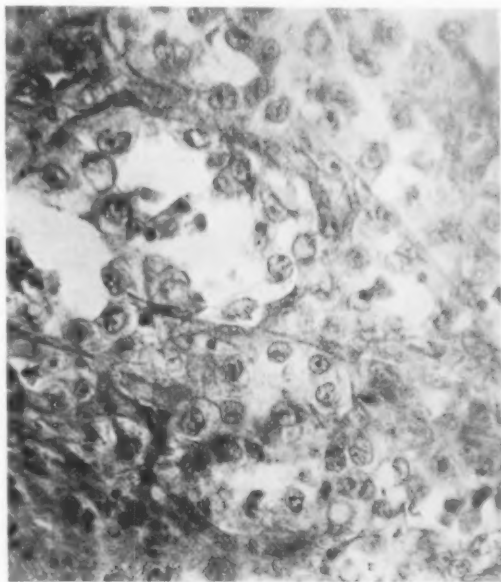


FIG. 2.—Higher magnification of area shown in Figure 1 (X200). Note the undifferentiated malignant cells.

CASE III (A115369).—Mrs. S. D. F., aged forty-six years, came to the Clinic in 1914, complaining of long-standing menorrhagia and pain, of about four months' duration, in the right lower abdominal quadrants. She had never borne children.

On examination a movable abdominal tumor was found which reached a little above the umbilicus.

At operation Dr. W. J. Mayo found a cyst of the right ovary about as large as a seven months' pregnancy. The specimen removed consisted of the uterus, tubes, and ovaries. The uterus contained multiple subserous and interstitial fibromyomas, the largest 2 cm. in diameter, the smallest 5 mm. There were adhesions between the right Fallopian tube and the cyst; the left tube apparently was unaltered, the left ovary was small, atrophic, gray, and fibrous. The right ovary was a large cyst, containing multiple papillomas scattered over the inner surface of

the wall, the largest being 7 by 5 by 3 cm. and the smallest 5 mm. in diameter (Fig. 6). Microscopically, the tumor was a papilloma covered by columnar epithelium, typical of papillary cystadenoma of the ovary (Figs. 7 and 8).

For seven years the patient was in fairly good health. She returned to the Clinic, December 13, 1921, because of frequent, burning and difficult urination and a definite sense of obstruction in the rectum and vagina.

Examination revealed a movable, hard, abdominal tumor pressing on the urinary bladder and rectum, coming well up to the umbilicus.

At the second operation a pelvic cyst about as large as a six months'

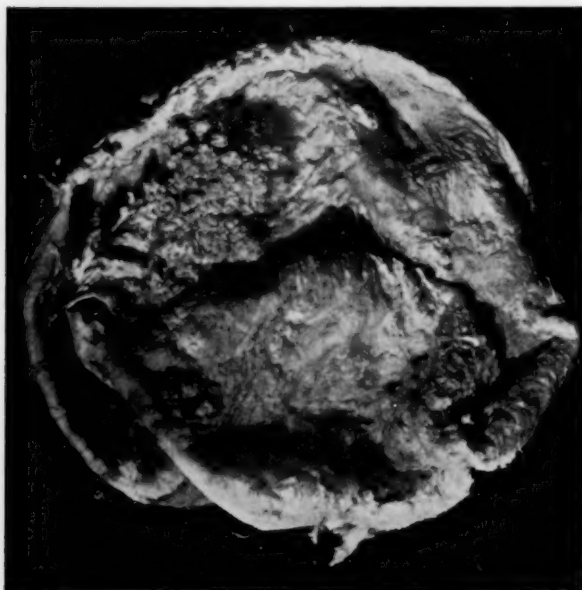


FIG. 3.—The lining of the dermoid cyst showing papillary epithelioma.

pregnancy was found; the cyst was adherent to the intestines, abdominal wall, sigmoid, omentum, and right ureter. The tumor contained serous fluid and in one area, on the inside, there was a firm, raised, flat, grayish-brown mass, covering a surface 1.5 by 1 cm. and projecting into the lumen 2 to 3 mm. (Fig. 9). Histologically, this tumor was composed of epithelial cells

growing from the cyst wall in the manner and form of a squamous-cell epithelium, in places showing definite keratinization (Figs. 10 and 11). The whole neoplasm probably arose from a cystic remnant of the papillary ovarian cystadenoma which ruptured during removal at the former operation.

Peters, Weiner, Williamson and Barris, and others, including Frankl, have reported cases similar to Cases I and II, but in a survey of the literature we have been unable to find a report of a case similar to Case III.

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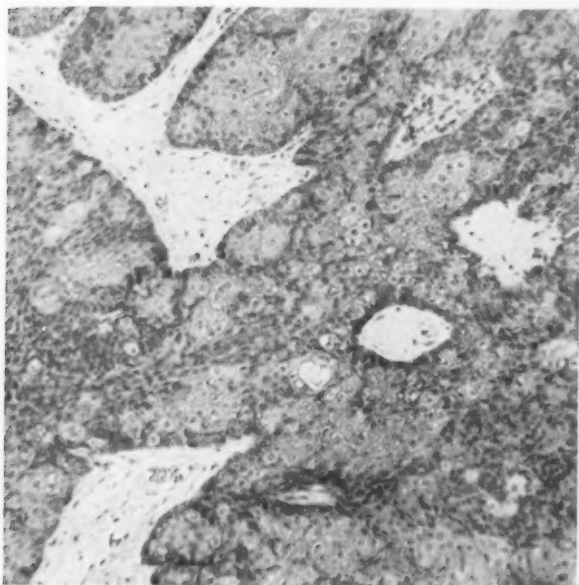


FIG. 4.—Squamous-cell epithelioma. Areas of the section show slight keratinization (X100).

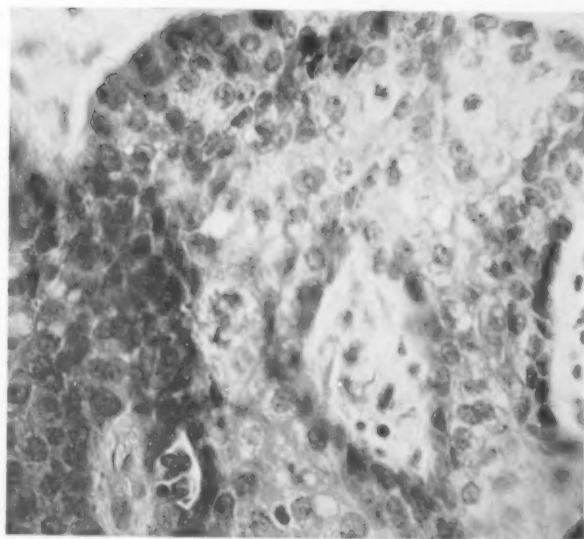


FIG. 5.—Detail of the malignant cells of epithelioma (X350).



FIG. 6.—The inside of the ovarian cyst showing the papillary tumor.

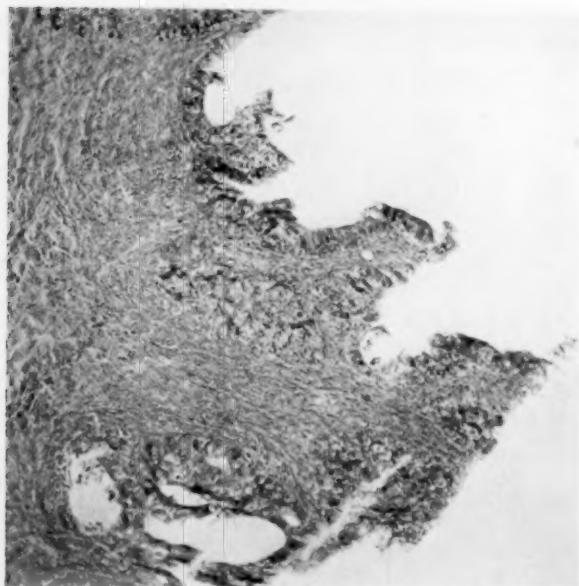


FIG. 7.—Typical papillary cystadenoma of the ovary (X50).

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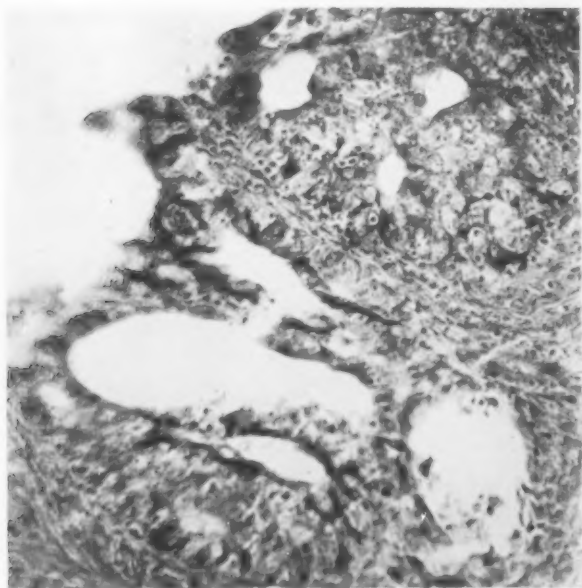


FIG. 8.—Epithelial cells covering the tumor (X120).

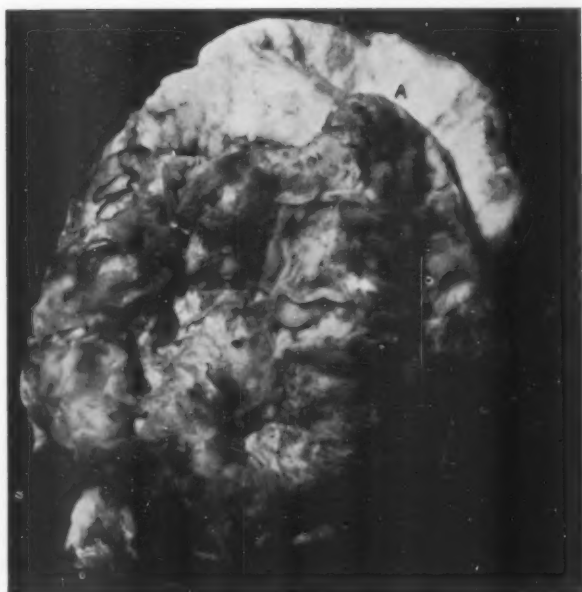


FIG. 9.—Inside of the ovarian cyst showing the raised epithelioma at A.



FIG. 10.—Typical squamous-cell epithelioma showing definite keratinization near the centre (X75).

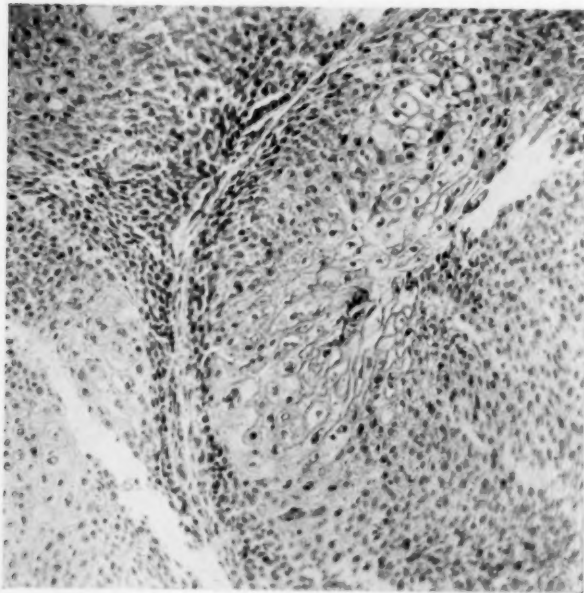


FIG. 11.—Details of the tumor, especially the differentiation of cells (X100).

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PRIMARY TUMORS OF THE URETHRA

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ENGLISH cites Gurlt's statistics from the Vienna Clinics to illustrate the rarity of primary carcinoma of the urethra. In one series of 16,637 cases of tumors of various organs, no instance of malignant growth of the urethra was noted; in another series including 4000 cases of disease of the male urinary organs only three were of carcinoma of the urethra. In 358 cases of carcinoma of traumatic origin collected by Löwenthal there were two of carcinoma of the urethra. The occurrence of benign solid tumors in this region is even more rare.

Five cases of solid tumor occurring primarily in the urethra have been treated at the Mayo Clinic. One of these was benign, the other four were malignant. Most malignant growths of the urethra are of epithelial origin and, similar to epithelial tumors elsewhere, trauma and irritation are important etiologic factors. The clinical course of tumors of the male and female urethra differs markedly.

Epithelioma of the Male Urethra.—The prostatic urethra is lined by epithelium similar to that of the bladder. The mucosa of the anterior urethra is more flat and compact than that of the prostatic urethra and in the fossa navicularis is definitely squamous cell in type.

Inflammatory irritation not uncommonly causes metaplastic changes on epithelial surfaces. Bohm describes metaplasia of the intestinal mucosa; Deetz notes the same condition in the gall-bladder, as does Hallé in the renal pelvis and ureter. Similarly chronic infection and irritation are important factors in the production of neoplastic changes in the urethral mucosa. Wassermann and Hallé, and Cedercreutz have described a state of epidermization of the urethral epithelium due to urethral infections. Dittel and Kaufmann²⁸ also demonstrated definite epidermization associated with urethral stricture. The forceful flow of infected, irritating urine through the narrow cicatrized passage and the frequent traumatic dilatation with instruments produce a protective hyperplastic reaction. Thiersch was the first to call attention to the malignant transition of these cicatrized, thickened areas. He reported a case of squamous-cell epithelioma developing on a long-standing stricture. Posner, in 1904, collected twenty cases of primary carcinoma of the male urethra; twelve of the patients had previously had

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urethral strictures. When these tumors develop following long-standing infection and stricture they have a structure similar to that of tumors forming on other squamous-cell surfaces. In most cases the irritation of the growth quickly causes symptoms and leads to an early diagnosis.

In some cases urethral carcinomas are preceded by long periods of urinary difficulty and irritation. The tumor formation is somewhat analogous to the long-standing premalignant stages preceding the development of squamous-cell tumors of the urinary bladder. König reported a case of urethral carcinoma developing after urinary obstruction of forty-eight years' duration, and Oberländer noted a somewhat similar case developing after forty years of urinary difficulty. Not all urethral carcinomas are preceded by long-standing urinary trouble; in young persons the onset is sometimes quite rapid. Hutchinson noted a case of a man who had had only three weeks of obstruction and pain before a definite area of malignancy was discovered. Albarran reported a patient who had symptoms of only six months' duration. Barney and Fuller both reported cases of sudden onset with acute retention. Schustler reported a case of acute retention with fourteen days of uræmia, followed by death.

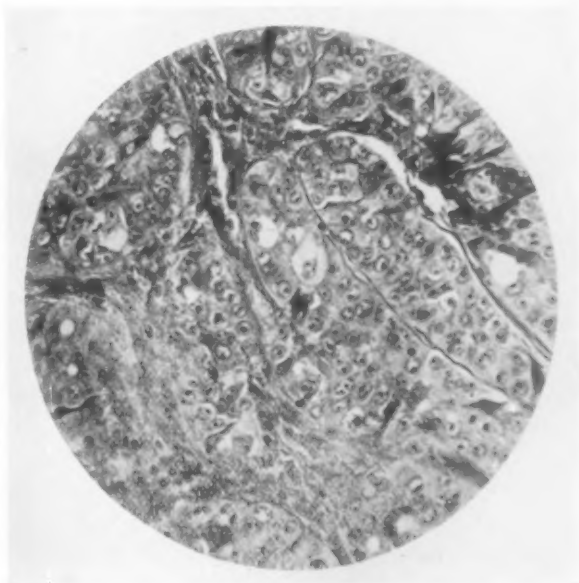


FIG. 1.—(Case 211630.) Epithelioma of the male urethra. Highly cellular structure with moderate fibrosis (X180).

Traumatic strictures in some cases have the same malignant potentialities as those of infectious origin. Trzebicky reported a case of squamous-cell carcinoma developing on a traumatic stricture of ten years' duration. Witsenhausen reported the case of a man who developed a traumatic urethral stricture following a blow on the penis. The stricture persisted thirty-eight years before malignant changes occurred. Löwenthal cited a similar case of a man kicked in the perineum; a traumatic stricture formed and after thirty years of urethral obstruction malignancy developed in the region of the scar. Soubeyran noted the case of a man of sixty-four, a sex pervert, who developed a squamous-cell carcinoma of the urethra after frequent instrumental urethral manipulations.

The majority of carcinomas which follow long-standing infection and trauma are in men of the cancer age and commonly occur at the usual site

of stricture formation, in the cavernous and membranous urethra. Occasionally they occur in the penile urethra, and but rarely in the fossa navicularis. Of forty-two cases of carcinoma of the male urethra collected by Preiswerk, thirty-eight were in the membranous or cavernous urethra.

Most of these tumors have a histologic structure similar to that of squamous-cell epithelioma of the penis, though of a higher degree of malignancy. There is moderate hyalinization and pearly body formation, but rarely so extensive as in the uncommon and histologically similar tumors located in the bladder. In most cases there is an extensive lymphocytic infiltration and the masses of tumor cells are walled off by fibrous tissue. Metastatic growths, which are not common, have the same tendency to remain

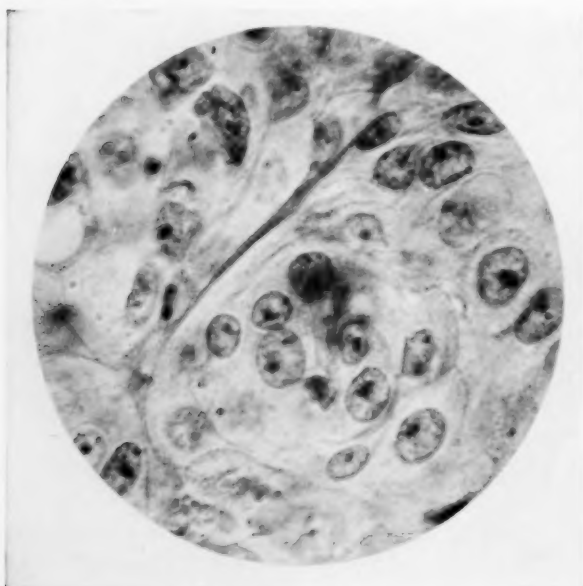


FIG. 2.—(Case 211630.) Highly malignant cells with prominent nucleoli. Tendency toward epithelial pearl formation (X 500).

localized in the primary glands as do those arising from epitheliomas of the penis. In young men the carcinoma is more likely to be papillary than squamous-cell, and the long premalignant period of trauma and infection is generally absent. Papillary carcinomas in most reported cases were extremely malignant; they rapidly infiltrated the surrounding tissues and metastasized freely. Hutchinson reported the case of a man, aged twenty-two years, with a papillary carcinoma of the urethra; ulceration through the body of the penis occurred three weeks after the onset of the swelling and obstruction. Six weeks after the first symptoms the regional glands were involved. Bosse reported a similar case in a man, aged twenty-five years, who had involvement of the inguinal glands after only a few months of symptoms. Following incision, the growth spread to the retroperitoneal glands and death occurred several months later. In these rapidly growing carcinomas in young men the tumor is not infrequently in the anterior urethra. Ottow noted a case in a man of thirty-three, with an extensive carcinoma completely filling the fossa navicularis; the growth had developed after a period of only four weeks of urinary difficulty. Similar tumors of the fossa navicularis were also reported by Lécene, Scott and Fuller. Squamous-cell tumors of a moderate degree of malignancy are also occasionally seen in this location although they generally occur in old men. Ménard

localized in the primary glands as do those arising from epitheliomas of the penis. In young men the carcinoma is more likely to be papillary than squamous-cell, and the long premalignant period of trauma and infection is generally absent. Papillary carcinomas in most reported cases were extremely malignant; they rapidly infiltrated the surrounding tissues and metastasized freely. Hutchinson reported the case of a man, aged twenty-two years, with a papillary carcinoma of the urethra; ulceration

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reported a case in a man, aged fifty-seven years, and Shattock a case in a man, aged fifty-four years.

Malignant disease of the male urethra is not uncommonly associated with urinary sinuses, which generally result from urinary obstruction and extension of the malignant process. Gayet, Lavenant, König and Röpke all reported cases of this type. In a small number of cases the formation of the fistula is possibly one of the determining factors in the development of malignancy. The irritation of the urine on the cutaneous border and along-standing, low grade infection tend to induce a protective hyperplastic reaction in the epithelial margin. The cell structure in these irritated areas at times approximates the histologic formations seen in low grade epitheliomas. Paget, Orth, and Guiard have called attention to the epithelial transition which takes place in old fistulas and sinuses. Poncet reported two cases of carcinoma developing in a fistulous tract. The first was in a man who in early life had had chronic urethritis; following urethral dilatation a peri-urethral abscess developed; this was incised and a fistula formed which drained for sixteen years. A malignant process developed around the fistulous tract with rather sudden onset of symptoms.

In the second case the carcinoma developed on the border of a perineal sinus six months after incision of a peri-urethral abscess. Guyon noted the case of a man who developed a carcinoma of the urethra following chronic urethritis and multiple fistulas of ten years' duration. Englisch cited a case in which peri-urethral abscess and fistula drained three years and was followed by the development of malignancy. The case of a man with carcinoma of the urethra which followed a long-standing urethral stricture is reported herewith:

CASE A211630.—Mr. G. T., aged forty-eight years, came to the Clinic, October 23, 1917. In his youth he had an infectious urethritis and for twenty years a urethral stricture requiring frequent dilatation. He had a set of urethral sounds which he used often. For three months, he had had difficulty in keeping the urethra

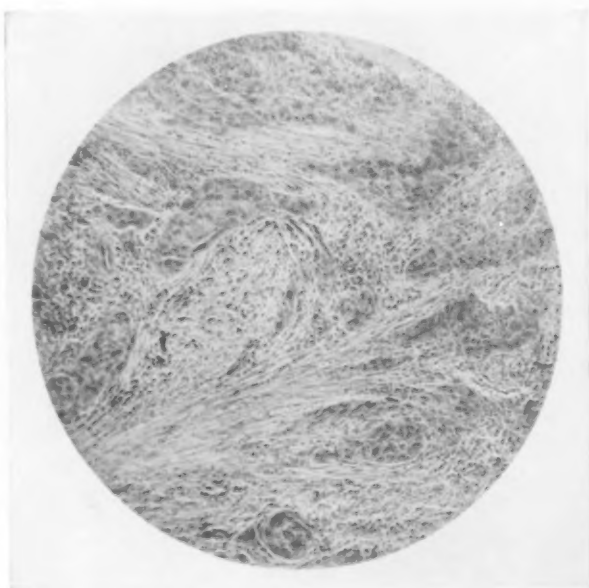


FIG. 3.—(Case 112110.) Squamous-cell carcinoma of the urethra; slight hyalinization and marked fibrosis (X 70).

open, and had noticed a gradually increasing swelling of the perineum. His general health was good.

A hard nodular mass, 2 cm. in diameter, was found in the perineum at the penoscrotal angle. The urethra was markedly obstructed in the region of the mass, but it was possible to pass a filiform bougie to the bladder. The stricture was dilated several times but rapidly recurred, finally producing almost complete obstruction.

At operation a growth 4 cm. long was found at the juncture of the membranous and anterior portions of the urethra. The involved area was completely excised. Later, complete emasculation of the penis and testicles with dissection of the inguinal glands was advised, but refused by the patient. The portion of the urethra removed contained an irregular firm tumor, about 3 cm. in diameter. Histologically, the tumor was made up of masses of large epithelial cells with only

a small amount of supporting tissue. The cells were large and irregular in size, and contained large nuclei and prominent nucleoli. There was slight cellular hyalinization and a few small epithelial pearls. Atypical mitotic figures were common and there was an extensive fibrosis and round-cell infiltration. The growth was a well-localized squamous-cell epithelioma of a high degree of malignancy. (Figs. 1 and 2.)

Six weeks later the urethra was reconstructed from a section of the internal saphenous vein. Two months later the area had completely healed, save for

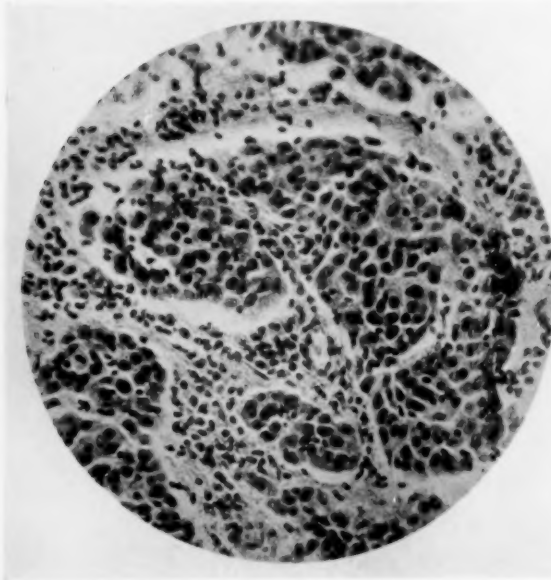


FIG. 4.—(Case 262718.) Mass of malignant cells from urethral tumor. There is no tendency toward hyalinization or pearly body formation (X 180).

a persistent perineal sinus. Three hundred fifty milligram hours of radium were applied to the urethra in the region of the scar through the perineal sinus.

The patient was alive at the end of five years. Whether or not there had been recurrence was not ascertained.

Epithelioma of the Female Urethra.—Primary carcinoma of the female urethra is occasionally confused with carcinoma of the vulva and vaginal wall, especially in the later stages. Many of the cases reported as carcinoma of the urethra in reality belong to the group of vulvo-urethral tumors. Various reports of collected cases have been published, especially those of Ehrendorfer, Vineberg, and Percy. In 1912, Whitehouse collected forty-three authentic cases from the literature. Thirty-two of these were of the vulvo-urethral type; the other eleven were primary urethral tumors. The

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vulvo-urethral tumor is generally papillomatous and fungating and often starts on the urethral margin as a small hard nodule. Primary carcinoma of the urethra in most cases develops in the mucosa.

The majority of malignant tumors of the female urethra are squamous-cell carcinoma of a somewhat higher type of malignancy than histologically similar tumors occurring on the cutaneous surfaces. They generally respond readily to radium radiation.

Ehrendorfer holds that local inflammatory processes are predisposing factors in the etiology of these growths. Hallé described a leukoplasia of the urethra resulting from protracted urethritis as a possible precursor to malignancy, similar to premalignant conditions in the male urethra.

Whitehouse divides epithelioma of the female urethra into two types, first, an irregular elongated ulceration involving only the mucous membrane of the urethral floor, usually occurring in the distal segment, and second, a peri-urethral indurated tumor with a tendency to involve surrounding tissue extensively and occlude the urethral canal.

In the first type the growth is generally of a high degree of malignancy with only slight cellular differentiation.

In the second type, the prognosis is more favorable; ulceration occurs late and fibrosis and hyalinization are prominent features. In some cases the growth is polypoid, a red fungating mass which may be pedunculated and protrude from the urethra. The primary neoplasm may grow very slowly and cause only a few symptoms, as sometimes occurs in carcinoma of the prostate. Attention may be directed to the primary focus only by finding a metastatic growth.

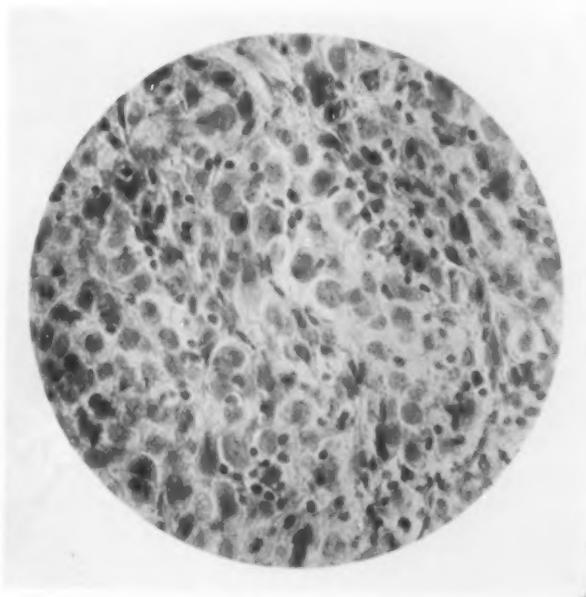


FIG. 5.—(Case 262718.) Irregularity of size of malignant cells together with marked lymphocytic infiltration (X500).

THREE CASES OF PRIMARY URETHRAL CARCINOMA IN THE FEMALE

CASE A112110.—Mrs. M. B., aged forty-four years, came to the Clinic, August 4, 1914. Twelve years before several small tumors had been removed from the meatus with the cautery, since then she had had moderate dysuria and frequency of urination. Sixteen months before her home physician had noticed three small nodules protruding from the urethra and had removed them; this was followed by occasional slight bleeding from the urethra and painful urination.

On examination a hard, ulcerated, nodular growth was found protruding from the urethral orifice and involving the outer half of the urethral canal. On cystoscopic examination the bladder, internal sphincter, and internal half of the urethra were found to be normal. A specimen removed for diagnosis revealed a squamous-cell epithelioma with only slight hyalinization and rare pearly-body formation; there was marked fibrosis and an extensive lymphocytic infiltration. (Fig. 3.)

The growth and the external urethra were charred with the Percy cautery. The wound healed promptly. Six months later a small, hard, nodular growth protruded from the urethra and was cauterized with the Percy cautery. In four months there was another small growth, to which a 22 mg. capsule of radium was applied in four periods of fourteen hours each. Only a slight reaction followed the treatment and the growth disappeared rapidly.

The patient was without recurrence and perfectly well six years later.

CASE A262718.—Mrs. G. F., aged fifty-three years, came to the Clinic, March 5, 1919. Nine months before she had noticed enlarged, hard inguinal glands on the left side. They grew rapidly, and were removed three months before. One month before she had noticed a small mass in the urethral orifice, and soon after dysuria and perineal irritation appeared. The urethral mass increased slowly in size.

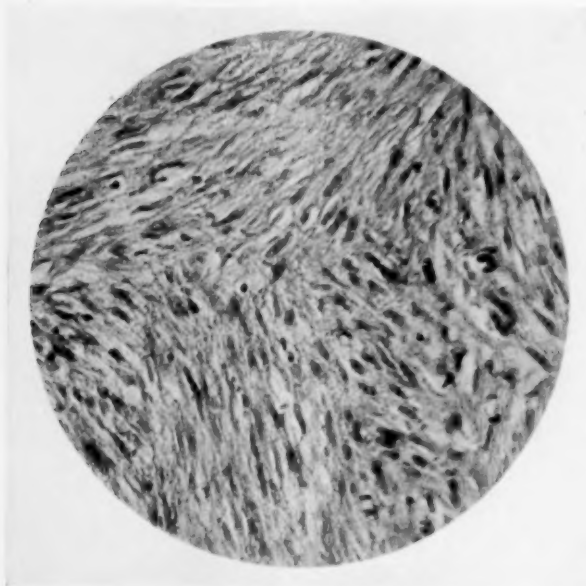


FIG. 6.—(Case 60418.) Fibroma of the urethra (X180).

Examination revealed a tumor 2 cm. in diameter in the middle urethra. On cysto-urethroscopic examination, a nodular, firm growth was found to involve the entire right wall and a part of the left wall of the urethra, extending almost to the orifice. The bladder was not involved. On microscopic examination of an excised specimen the tumor was found to be epithelioma. The cells were markedly irregular in size; some were enormous. No pearly bodies and very little hyalinization was seen. There was moderate fibrosis and an extensive lymphocytic infiltration (Figs. 4 and 5). The case was not considered satisfactory for surgical treatment. Two hundred milligram hours of radium was applied to the vulva in two doses one week apart. Three months later 2000 mg. hours was applied to the urethrovaginal orifice in three applications one week apart.

Six months later the patient was apparently in good health although she had lost 30 pounds. The urethra was indurated and there was some peri-urethral thickening. Masses could be felt in both lower abdominal quadrants. The vagina was negative. Cystoscopic examination at this time, one year after the first

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examination and fifteen months after the first onset of symptoms, showed the tumor still present in the urethra and an extensive involvement of the anterior wall of the bladder. The growth was obviously inoperable. Two hundred milligram hours of radium was applied to the posterior urethra and anterior bladder wall. The patient died six months later. Necropsy was not obtained. Until shortly before death she had only moderate urethral irritation although she complained at times of severe abdominal discomfort. The radium undoubtedly delayed an extension of the malignant process and by partial relief of the local condition prevented obstruction of the urethra. The case is of interest in that it shows an extension of the process internally to the bladder. The majority of these growths extend outward and later involve the vulva. On the other hand the urethral mucosa has an unusual resistance to invasion of tumors from other areas. Vesical tumors, even when extensively involving the bladder mucosa, practically never extend into the urethra.

CASE A319698.—Mrs. E. W., aged thirty-four years, came to the Clinic, June 14, 1920. Eighteen months before she had had a miscarriage; since then she had been troubled with frequency, bleeding, and leucorrhœa. Three months before her doctor had found a growth about 3 cm. in diameter protruding from the urethra. This growth had been removed six weeks before and on microscopic examination was found to be malignant. The frequency and dysuria had moderated, and urethral bleeding was occasional and slight.

The urethral opening was slightly reddened. Two small tags projected from the right urethral wall near the external outlet. These tags were removed and examination showed the growth to be an epithelioma. The inguinal glands were enlarged (about 1 cm. in diameter) on both sides.

Two hundred milligram hours of radium was applied to the urethra and 800 mg. hours to both the right and the left groin. In three months the urethra was clear but the enlarged glands persisted. Five hundred milligram hours of radium was applied to both inguinal areas in six applications. Eleven months later the patient's urethra was negative and there were no palpable glands. Her general health had improved considerably.

Adenocarcinoma.—Whitehouse asserts that urethral adenocarcinoma in the female originates in the peri-urethral glands, and that it is analogous to prostatic carcinoma in the male. Most of the few cases reported occurred in young persons. The tumors are of about the same degree of malignancy as the urethral epitheliomas. Lockyer removed a glandular malignant area 1 cm. in diameter which was attached by a wide base to the urethral floor in a female. There was no recurrence at the end of two years. McMurty reported two cases of adenocarcinoma of the urethra; one in a woman of forty-seven who had a recurrence twelve months after removal, the other in a woman of twenty-six; this patient was free from recurrence one year after a radical excision of the growth. Battle removed the urethra completely for extensive adenocarcinoma in a woman of fifty-eight. The neck of the bladder was closed and a suprapubic drainage established.

Glandular types of malignancy are seldom observed in the male urethra. Oliver and Clunet reported the case of a man of fifty-two with a small nodular adenocarcinoma 3 cm. from the meatus. Two years later the mass had ulcerated through the corona and extensively involved the glands. Usually the growth appears in the glands at the base of the penile urethra

and may be confused with primary urethral tumors. Such extra-urethral tumors cause fewer symptoms; they grow more slowly and generally attain a large size before pain or urinary symptoms develop. They have a tendency to recur after removal. They may completely surround the urethra but they rarely involve the urethral mucosa. Paquet and Herrmann reported a case of a man of sixty-five who for two years had a small mass between the bulb of the urethra and the rectum. The mass was removed and a tumor developed in Cowper's gland. Kocher noted the case of a man with a similarly located tumor. After four years of growth the tumor was excised but recurrence followed rapidly. Pietrzekowski reported the case of a male aged nineteen years with a tumor of Cowper's gland of enormous size. Rapid recurrence followed removal in this case also.

Sarcoma.—Sarcomas similar to connective tissue tumors in other parts of the body are most common in young persons. They may be pedunculated, and in the female often protrude from the urethra. They grow rapidly, metastasize extensively, and offer the patient a very poor prognosis. Maria-chess reported a case in a man aged twenty-two years, of a mass in the penis which rapidly increased in size; four months after the onset, the growth caused complete obstruction. Mark observed a case in a man aged twenty-four years. The growth was in the anterior urethra and caused severe dysuria and terminal hematuria. Several months later the whole urethra was involved. Kaufmann²⁷ reported the case of a spindle cell sarcoma occurring in a man aged fifty-five years, and Albrecht, a case of pigmented sarcoma in a man, discovered at necropsy.

Melanotic sarcoma occasionally occurs in the female urethra. It is extremely malignant and involves surrounding tissue extensively. Reed observed abdominal metastasis seven months after the removal of a pigmented urethral growth from a woman of sixty-four. Mundel reported a case of melanotic sarcoma which projected from the urethral orifice; the patient died eight days after operation from pneumonia. Watson noted a case of inoperable myxosarcoma which grew from the urethral orifice; the patient died four months later. Cases of spindle-cell sarcoma occurring in women are reported by Hirst and McWeeney.

Angioma.—Angiomas are found more often in the male than in the female, and in the young person. Only a few cases are reported, and undoubtedly some of them, as Rokitsky holds, are more representative of simple hypertrophy of vascular segments than of neoplastic overgrowth. They have a tendency to bleed freely; they cause little pain or urinary discomfort, and in most cases respond readily to fulguration. Forgue and Jeanbrau report the case of a boy fourteen years who had an abundant painless urethral hemorrhage. On urethroscopic examination a large irregular angioma was found filling the posterior urethra. The mass disappeared completely after repeated fulguration, leaving a urethra of normal elasticity. Wolf and Seifert both report similar cases successfully treated by fulgura-

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tion. Similar to other connective-tissue tumors of the urethra, angioma may be pedunculated. Petit noted a small angioma in a woman which as a result of repeated straining had been partly forced from the urethra. It was attached by a long narrow pedicle to the urethral mucosa. Banzet removed a small angioma from the upper wall of the urethral canal in a female; the tumor recurred rapidly.

Fibromyoma.—Fibrous nodules are often found in the prostatic urethra in men over fifty; they are only rarely seen in the penile urethra. Halstead reported the case of a man of twenty-four with a small mass in the anterior urethra. In six months the growth obstructed the urethra. It was about 2 cm. in diameter, freely movable, and only slightly sensitive. At operation it was found to be attached to about three-fourths of the urethral circumference. Histologically it was a true fibroma.

Fibromyomas occur more often in the female urethra than in the male. In the female they may be attached to any part of the urethra, but usually to the posterior half. They are generally covered with urethral mucosa, small, and cause but few symptoms. They are unattached to the periurethral tissues, and shell out readily at operation. They bleed only slightly and offer very little obstruction to the urinary stream. They may grow rapidly and attain an enormous size. If they are large they are usually attached to the urethra by a pedicle. Tumors of this type are reported by Temoin and Höning. In Höning's case the tumor was 30 cm. in diameter and was connected with the urethra by a long narrow pedicle. The whole mass rested on the vaginal outlet. Wetherill reported the case of a woman with a slow growing fibroma of twenty years' duration. The patient desired operation only when the tumor interfered with walking. The growth was a pure fibroma. The large fibromyomas often show areas of degeneration and ulceration. Labhardt reported a case of a calcified fibromyoma in a woman of sixty-three. In an occasional case recurrence is early and extensive. Benoit excised a fibroma from the urethra of a woman of thirty-nine; three months later there was a large secondary growth. Histologically, the majority of these tumors are fibromas or fibromyomas. True myomas, for example those reported by Kretschmer and Büttner, are unusual.

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CASE A60418.—Mrs. F. E., aged twenty-six years, came to the Clinic, October 23, 1916. For twelve months she had noticed a small mass in the region of the urethra which had increased gradually in size. There had been no urinary disturbance, but straining often made the growth bleed, and at times the urine spattered. During the last four months, she had had slight vaginal bleeding between her menstrual periods.

Examination showed a nodular reddened mass 3 cm. in diameter protruding from the urethra. A diagnosis of benign tumor of the urethra was made.

At operation an irregular lobulated mass attached by a broad base to the outer half of the urethral mucosa was dissected from the urethral canal. About one-third of the growth protruded from the urethral orifice. The specimen removed was firm and nodular and covered with urethral mucosa.

Histologic examination showed the mass to be made up almost completely of fibrous tissue; no myomatous tissue was found (Fig. 6). In some areas interlacing fibrous strands separated the growth into numerous small spaces, some of which were filled with a thinly cellular collagenous material not unlike a mucous polyp.

Three years later the patient had not had a recurrence and was in good health.

Polyps and Papillomas.—Polyps and papillomas of the urethra are often seen. The majority are minute and are usually the result of long and tedious urethral infections. They have very little clinical significance. In most cases they disappear following treatment of the underlying infectious condition. In the male urethra the small growths usually occur in the region of the verumontanum and the internal sphincter. When located in the region of the verumontanum they may be associated with various sexual and neurasthenic disorders. Both the small and the large tumors respond readily to fulguration or snaring. Those occurring in the posterior urethra of the male may be pedunculated and occasionally interfere with the closure of the internal sphincter; those occurring near the external orifice are generally flat and sessile. Multiple and extensive growths are occasionally seen. Morrow reported a case of multiple polyps in a male urethra causing almost complete obstruction. The urethra behind the mass of polyps was tremendously dilated. Zuckerkandl reported a case in which a papillomatous growth covered the entire urethra. There is a tendency to rapid and extensive recurrence after removal. Elder and Lewin both reported cases in which the recurring papilloma completely filled the urethra.

SUMMARY

Malignant tumors of the male urethra often develop following long-standing urethral infections. Primary tumors are extremely rare both in the male and female. In the female they are generally located in the anterior urethra and tend to grow outward, away from the bladder.

Most malignant tumors of the urethra are squamous-cell growths. They are highly malignant but are well walled off by fibrous tissue and lymphocytic infiltrations. They tend to remain limited to the local condition and to the regional lymph glands and usually respond readily to radium treatment.

Three cases of epithelioma of the female urethra and one of the male urethra are reported from the Mayo Clinic.

Benign solid tumors are only rarely seen in the urethra. The majority of these belong to the group of fibromyomas. One case of fibroma of the female urethra is reported.

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MALIGNANCY OF THE UNDESCENDED TESTIS—ASSOCIATED WITH HYDROCELE *

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MALIGNANT disease occurring in the undescended testis is rather uncommon. It was the belief for many years that every undescended testis was peculiarly liable to undergo malignant degeneration. A study of the literature of the past twenty years on retained testes discloses the fact that malignant change in the undescended testis is a comparatively rare surgical lesion.

Eccles in his studies embracing 859 cases of cryptorchism found not a single case of sarcoma. Furthermore, in 40 cases of sarcoma of the testis, he found only one occurring in a retained testes. Coley's statistics of the Hospital of Ruptured and Crippled, including 1357 retained testes, likewise contained not a single case of malignancy. Coley has observed during the past 25 years, 65 cases of malignancy of the testicle, 52 of which developed in the normally descended testes and 12 in the undescended. Kocher found in 1000 retained testes only one in which malignant changes had taken place. He collected from the literature 59 such tumors. Odiorne and Simmons cite 54 cases of malignant disease of the testes observed at the Massachusetts General Hospital during a period of 26 years. Of these 6, or 11 per cent., occurred in the undescended testes. Brenner, of Eiselsberg's Clinic, between the years 1889 and 1918 operated upon 75 inguinal testes. Of these 2 were bilateral, 42 right-sided and 31 left-sided; 24 were operated upon before puberty and 51 after puberty. In the above series one case was associated with hydrocele, and in every subject, with the exception of two, there was an accompanying inguinal hernia. The two cases were associated with interstitial hernias. There was no instance of malignancy in this series of cases.

Bland Sutton, in 1910, could find in the museums of the London hospitals only 14 specimens of malignant undescended testicles. He states: "In a few cases the testis was retained in the abdomen, but in most cases it had entered the inguinal canal." Kaeplin remarks that many of the best-known French surgeons have never observed a single case. Bulkley (1913) says he found no cases reported before 1859 and since then has found only 57 malignant abdominal testes in the medical literature of France, Germany, Russia, Italy and English speaking race. Bulkley in 182,729 male admissions to general hospitals found three cases of malignant intra-abdominal testicles, and in 12,729 consecutive male admissions to the Presbyterian Hospital (New York City) found 13 malignant testicular tumors. Of the latter, 11 were in the scrotum and 2 within the abdomen. Bulkley's analysis of malignant scrotal and abdominal testicular tumors gives the relative frequency of the two conditions as about 1 to 15.

The monograph of Höffstatter, who carefully collected and studied the literature, further confirms the fact that the danger of malignant degeneration in

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retained testes is much less than has been supposed. Höffstatter personally observed 181 cryptorchids, of which 4 had undergone malignant changes, 2 sarcoma, 1 carcinoma and 1 teratoma.

Doctor Nassau informs me that in an active surgical experience in various hospitals covering a period of 25 years, he has observed only one case of malignant degeneration in the undescended testicle. In this same span of time he has removed eight malignant tumors occurring in endoscrotal testes.

Howard found among 110,000 male patients admitted to one of the large London hospitals during a period of 20 years, that there were 65 cases of malignant testicular disease. In 57 of these cases the diagnosis was verified by the microscope; 9 of the 57 were in the retained testes, 8 being in the inguinal canal and 1 just below the external abdominal ring.

Von Kahliden reports 41 malignant testes, of which 5 occurred in the retained testes.

Goeritz, in his study of 57 cases of operated undescended testes, found only one undergoing malignant changes.

Chevassau collected 128 cases of tumors of the testicle; of these 10 were inguinal and 5 abdominal.

Ufferduzzi collected and studied from various clinics, hospitals and pathological museums 159 testicular tumors which had been removed surgically or at post-mortem; of these, 6 occurred in the undescended testes.

In Hinman's study of 32 cases, 7 of the tumors occurred in the undescended testes, which Hinman states supports the view that malignancy is relatively more common in men with undescended testes than in those with normally descended testes.

Cunningham, commenting on the rarity of malignancy of the undescended testes, states that of 67 cases of malignancy of the testes observed at the Boston City Hospital, not one occurred in the undescended testis.

No statistics, however, approach the number of cases of undescended testes reported by Coley (1357), Eccles (859) and Kocher (1000). Collectively they total 3216 cases and in this unusually large number of cases there occurred but one undescended testis undergoing malignant degeneration. If, on the other hand, the various large series of malignant testicular tumors collected in this study, excluding reports of isolated cases, are totalled, they number 664. Of the latter 63, or 9.3 per cent., occurred in the undescended testes.

Von Foth (1910) collected 210 malignant testicular tumors occurring in the undescended testis; including the series of Kocher (55 cases), Monod (42 cases), Goddard (20 cases), Fischer (39 cases), Rademacher (10 abdominal testicular tumors) and a number of smaller series and reports of individual cases. Von Foth's collected cases were not included in this study as they give no index as to the relative frequency between growths occurring in endoscrotal testes and those occurring in undescended testes.

It may be said, therefore, that malignant changes in the undescended testes are relatively more common than in the normally descended testes, but that the danger of its occurrence has been greatly exaggerated and overestimated.

CASE — (History No. 21833, Doctor Nassau's service).—Patient was admitted to Mt. Sinai Hospital, December 31, 1920. The patient was a male, age forty-five, who was brought into the Emergency Ward because of the sudden and rapidly increasing enlargement of a mass over the right inguinal region. Five days before admission to the hospital (December 25, 1920), following an unusual physical effort, he was seized with acute, sudden, sharp, agonizing pain over the right

inguinal region. The mass previous to December 25, 1920, was symptomless and patient states that there was no apparent increase in size. The onset of the pain and the increase in the size of the lump were simultaneous, appearing abruptly and reaching the size of a foetal head within forty-eight hours.

Examination showed a well-developed and well-nourished male somewhat shocked and suffering severe pain over the right inguinal region. The latter area was occupied by a mass the size of a foetal head which had a tense, elastic, cystic feel and fluctuated slightly. The surface blood-vessels were somewhat dilated. Previous history is negative. He is the father of four children, all living and in good health. Occupation, tailor. The past history and family history are negative. Wassermann, negative. Heart normal in outline, sounds good, quality regular. Extremities negative, reflexes normal. Mucous membranes negative. Hair, scalp and nose negative. Pupils of the eyes equal, regular, react to light and accommodation.

The left testicle is in the scrotum and is apparently normal, penis normal, the inguinal lymph-nodes are not enlarged. The right testicle is absent from the scrotum. In the right inguinal region is a large, tense, cystic ovoid mass the size of a foetal head. Epididymis could not be palpated. Mass does not transmit light, probably due to thickening of the sac, and cannot be reduced into the abdomen.

The rapid enlargement of the right inguinal mass and the absence of the testicle from the scrotum of the same side prompted a tentative diagnosis of hæmatocele, or more probably hydrocele, associated with malignancy of the undescended testes, and operation was advised. The malignancy of the testicle had probably been present for some time, and, as is the case with many of the testicular tumors, the growth was symptomless and unnoticed by the patient. The sudden development of the hydrocele and its accompanying pain prompted him to seek immediate surgical aid.

Operation (December 31, 1920, by Doctor Lipshutz).—An incision was made extending from the external abdominal ring following the course of the inguinal ligament to a point one-half inch above the anterior superior spine of ilium. The testicle was found lying in an inguinal hydrocele and was removed. The incision was then prolonged to the costal margin to below the tip of the twelfth rib and the radical operation and dissection of the primary lymphatic area was carried out as described by Hinman. There was very little hemorrhage which was easily controlled.

The relative ease with which the retroperitoneal structures can be exposed was strongly impressed upon the right by a number of anatomical studies, which were arrived at in studying the variations in the anatomy of the ureter and hypogastric artery. No glandular metastasis was found. There was a hernia present, the sac of which was ligated and transfixed. A long drainage tube was placed close to the aortic bifurcation with exit at the upper portion of the wound. The suggestion of Hinman in cases with marked gland metastases to place a small rubber tube or catheter, in the end of which is fastened a 50 milligram tube of radium alongside the rubber drainage tube, seems worthy of utilization.

The wound was carefully sutured in muscle layers, care being taken to avoid injury to any of the nerves; to prevent subsequent relaxation of the abdominal wall. The drainage tube was removed in 72 hours. The patient's condition at the end of the operation was good and he made a speedy and uneventful recovery, leaving the hospital on the eighteenth day. He has recently been heard from (ten months after the operation) and is apparently perfectly well. He was also given twenty injections of Coley's fluid and intensive post-operative X-ray radiation.

Gross Examination.—The specimen consists of a solid tumor of the testis

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measuring $11 \times 7\frac{1}{2}$ cm. It involves the testes and epididymis and fuses with the surrounding tissues. The tumor is covered with numerous and varying sized nodules exceedingly vascular and is encapsulated by a thin, tense, fibrous capsule presenting on its surface three small hemorrhagic cysts. The testicle cuts with resistance and on section numerous cavities filled with a colloid material are seen scattered over a large part of the tumor. Normal testicular tissue cannot be found. The whole tumor is quite cedematous.

Microscopic Examination.—The tumor is very cellular and is composed of large, round, oval and polyhedral cells with but little reticulum or stroma between the cells. In some places an alveolar arrangement can be seen, but most of the tumor does not allow an alveolar arrangement. Many of the cells resemble groups of lymphocytes. The nuclei are large, stain deeply and have a homogeneous ground-glass appearance. No glandular structures or other teratomatous elements are seen. The cytoplasm stains faintly. The tumor presents the characteristics of the group of testicular tumors classified by Schultz and Eisendrath as spermatocystoma or so-called Seminome of Chevassu.

Comment.—Ewing in 1911 and Schultz and Eisendrath in 1921 made painstaking critical analyses of the pathology of testicular tumors, adding greatly to our knowledge of these growths, thus aiding to clear up one of the most confusing fields in pathology. Schultz and Eisendrath state that all the tumors can be divided into two groups which will cover all the malignant tumors of the testes of clinical importance, (1) embryonal carcinoma and (2) spermatocystoma. The age incidence of these groups is suggestive. In the first group the average age is 29 years, in the second group the average age is 41; showing the characteristic homogeneous, deeply staining, finely or coarsely granular nucleus. The high average age incidence of the second group is not due to a longer clinical duration of the tumors of this group; on the contrary their rate of growth is more rapid and the duration shorter in the second than in the first.

Schultz and Eisendrath believe that the glandular or adenomatous character of the malignant tumor of the testicle is the best criterion of the teratomatous origin of such tumors. Ewing's designation of this group of tumors as embryonal carcinoma seems the best and is also adopted, as noted above, by Schultz and Eisendrath.

Spermatocystomata, the large-celled medullary tumors so commonly designated in the literature as "sarcoma," are believed by Schultz to arise from the epithelium of the seminiferous tubules. Schultz and Eisendrath suggest the name spermatocystoma for this group of tumors, to indicate their origin from cells of the spermatogenic cycle, as perhaps better than Seminome of Chevassu. The reader is referred to Schultz and Eisendrath's paper for the detailed study of the histogenesis of malignant tumors of the testicle. Ewing believes that the malignant testicular tumors are of teratomatous origin and are the result of one-sided development and overgrowth of a typical epithelial tissue.

Lymphatics.—Malignancy of the testicle spreads by the lymphatics rather than by the blood stream. Generalization is in the majority of cases through

the lymphatics. The richness of the lymphatic plexus of the testes readily explains the early glandular metastases. The lymph-vessels are usually more superficial than the blood-vessels with which they are in intimate contact. The testes have a rich superficial plexus beneath the tunica albuginea. They unite with the lymphatics of the epididymis and form from four to eight collecting trunks which ascend with the spermatic veins in the spermatic cord along the front of the psoas major in the subperitoneal tissues to the level where the spermatic vessels cross the ureter. Here they part from the blood-vessels and spray themselves fountain-like into the lateral and pre-aortic lumbar nodes below the renal vessels. Some of the vessels divide in their course and empty their contents into more than one node. The primary lymph-nodes are those in front of and by the sides of the aorta and vena cava below the level of the renal veins.

Each testicle has its own set of lymph-nodes which communicate with each other and both sets receive lymph from other structures. Cancer of the testicle metastasizes in practically every case first and primarily to this limited zone of lumbar lymph-nodes.

Right Testicle.—One to three lymph-nodes lie in the groove between the aorta and the vena cava. The more caudal of these nodes is situated above the bifurcation of the postcava. One or more nodes lie in front of the aorta (preaortic nodes) between the renal vein and the origin of the inferior mesenteric artery. A node may also be present to the right of the postcava between it and the right renal vein. Bartels and Cuneo state that one of the lymph-vessels constantly passes to a node situated on the ventral surface of the aorta at its point of bifurcation. In one third of the cases it is present at the level of the promontory of the sacrum; at which site the aorta occasionally bifurcates (Lipshutz).

Left Testicle.—The glands lie at the left side of the aorta generally in a cluster behind the inferior mesenteric artery and between the two great trunks (aorta and postcava) below the level of the renal veins. Some of the lymphatics reach the preaortic nodes above the origin of the inferior mesenteric artery. A chain of glands is also present on the outer side of each common iliac artery.

Zeissel and Horovitz describe a lymph-vessel which passes from the testicle to the posterior surface of the bladder to terminate in a lymph-node of the external iliac chain. This lymph-node lies on the external iliac vein where the latter vessel is crossed by the ureter. Most and Bartels were unable to inject this node in man. Bruhns and Jamieson and Dobson, however, successfully demonstrate this node. Cuneo by injection from the testicle also demonstrates this node at the point where the ureter crosses the external iliac vein.

The secondary lymph-nodes or those receiving efferents from the primary nodes are injected with great rapidity. They are composed of three groups,

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(1) primary nodes of the same and opposite sides, (2) nodes behind and between the two great trunks (aorta and vena cava) below and above the renal veins, (3) a chain of nodes along the outer side of the common iliac artery.

The glands vary greatly in number and in their arrangement. In two-thirds of the cases the lymph-nodes of the left testicle are placed at a somewhat higher level than those which receive the trunks from the right testicle.

Surgically, we regard the lymph-nodes as lying in an area bounded above by the renal veins, at the sides by lines drawn vertically a finger's breadth outside the vena cava and aorta respectively, and prolonged to cross the external iliac arteries above the junction of the upper and middle thirds, below the lines drawn from the bifurcation of the aorta to meet the extremities of the vertical lines (Jamieson and Dobson).

Most considers the primary lymphatic nodes as a very imperfect barrier. Jamieson and Dobson state that the secondary lymph-nodes are injected with great rapidity. A fact further confirmed by the great frequency of reports of left subclavicular and supraclavicular adenopathy in malignant disease of the scrotal and inguinal testicle. Most further demonstrates the passage of lymph-vessels from tunica vaginalis to the region of the cysterna chyli. It may be noted that the supraclavicular adenopathy may have its origin in visceral metastases from the liver following malignancy of the testicle.

Küttner has demonstrated the passage of lymph-vessels from the liver and stomach to the supraclavicular nodes, particularly on the left side. The appearance of large nodes in the supraclavicular area may also be the result of invasion of the thoracic duct. Metastases in the supraclavicular nodes originating from tumors of the testes and abdomen associated with invasion and occlusion of the thoracic duct, have been explained by several observers as illustrations of retrograde lymphatic growth. It is a late symptom as is evidenced by its occurrence in cases of malignancy of the testes, with metastatic tumor formation in the skin and skeleton. In one case of Monod's series of testicular tumors, there appeared multiple cutaneous metastatic nodules scattered over the cutaneous surfaces. Similar cases have been described by Trelat, Duplay, Guyon, Kocher, Miyata, O'Crowley and Maitland and others. Of 34 malignant tumors of the testicle, Butlin found the lymph-nodes free in only three.

Invasion of the spermatic and iliac veins with continuous tumor growth extending as far as the heart has been observed with chondrosarcoma and chorioma. Discontinuous metastases by way of veins are most frequent and they give rise to tumors of the lungs, brain, kidney and stomach.

Hydrocele.—The occurrence of hydrocele is an uncommon complication of undescended testes. The accompanying hydrocele may be of any type. The types of hydrocele that may be found with retained testes are the following (V. Foth).—1. Complete inguinal or abdominal hydrocele. 2. Hydrocele of the tunica vaginalis in an inguinal testicle. 3. Hydrocele multilocularis

abdominalis with an inguinal testicle. 4. Hydrocele funiculi spermatici with an inguinal testicle. 5. Hydrocele communicating with an inguinal or abdominal testicle. 6. Hydrocele bilocularis with cryptorchism.

The hydrocele may be congenital (hydrocele neonatorum) or may have its genesis in trauma as in the case herein described. Often the hydrocele is present as a fluctuating swelling in the inguinal canal within which lies the testicle, with the additional presence laterally or medially of a hernia, as in the case here reported. One finds at times in young children in which at birth the left testicle is absent from the scrotum and some days later the testicle reaches its normal site, there occurs an accumulation of fluid in the tunica vaginalis testes.

Bescancon reports two cases of inguinal testes connected with scrotal hydroceles. Rothman collected 30 cases of hydrocele accompanying the undescended testes. Rothman, Ufferduzzi, Coley, Hubbard and others report cases of hydrocele bilocularis accompanying an undescended testis. Coley in a considerable number of cases found a bilocular sac in which the upper portion assumes the inguino-superficial variety, resting upon the aponeurosis beneath the skin and superficial fascia and the lower loculus extending down into the scrotum. In these cases the testis usually occupies the upper loculus. The latter types of hydrocele are due to an abnormal diverticulum of the processus vagini peritonei. The processus vaginalis which in the female has no significance is a peritoneal diverticulum through which the ostium abdominalis communicates with the abdominal cavity. This blind sac extends caudally irrespective of the position of the testes to the scrotum. On the arrival of the testis in the scrotum the gubernaculum shrinks away. The abdominal opening of the processus vaginalis is closed through the apposition of its peritoneal surfaces and is the fovea inguinalis lateralis. Normally the closure of the processus vaginalis proceeds rapidly after birth.

Variations in the descent of the testes are often associated with variations of the processus vaginalis peritonei in the nature of diverticuli between the layers of the abdominal wall and under the skin and are also the direct cause of interstitial and præaponeurotic hernia.

It is interesting to note that Osler in 1907 calls attention to the diagnosis of abdominal tumors in the male and states that no such diagnosis is complete unless an examination of the testis has been made. He reports three cases of abdominal tumors due to retained abdominal testes associated with probable hydrocele and glandular metastases. It may be noted that as the intraperitoneal nodes are often involved, an epigastric tumor is frequently the first sign of recurrence. Clendenning and Outland report an enormous abdominal cyst due to a retained testis. There are also case reports of abdominal hydrocele in women. The cases of Abel and Marion were testicular abdominal tumors occurring in hermaphrodites with the normal external genitalia of women and were diagnosed uterine myoma, the true nature of which was not disclosed until the abdomen was opened at operation.

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Microscopic examination of the growth showed normal testicular parenchyma and they were both cases of carcinoma of the abdominal testes.

Trauma.—Ewing states that trauma seems to be the sole tangible factor in originating many tumors of glia tissue, testicle and many other organs. By trauma is here understood single or repeated more or less contusing, crushing or lacerating mechanical injury. Single severe trauma has frequently been followed by the development of a sarcomatous tumor, although rarely by carcinoma.

Osler and others have commented on the influence of trauma as a factor in causing the rapid generalization of a malignant growth.

Fischer collected six cases of carcinoma of the undescended testes which he believed were due to the wearing of a truss. The inguinal testicle which has been described as a "cherry hanging on a stem" is so situated as to render it more susceptible to trauma than the endoscrotal testis. Furthermore, every contraction and every movement of the abdominal muscles compresses and injures the inguinal testis. The abdominal testicle is relatively free from these effects and is only influenced by a distended bladder, peristalsis, etc. The effect of intra-abdominal pressure can only be conjectured. Bulkley says that only two of his 59 collected malignant abdominal testes gave a direct history of trauma.

Katzenstein, Finotti and others have attributed the occurrence of malignant degeneration to disturbed function and embryologic defects.

The histologic alteration present in the undescended testis does not seem to be an etiological factor of importance in the development of malignancy in the retained testis, when the fact is recalled that malignant degeneration in an undescended testicle which has been placed in the scrotum by operation is of extreme rarity. The writer in a perusal of the literature has been able to find but three cases in which the latter eventuality occurred; one reported by Coley, the second by Cunningham and the third by Gordon Taylor. Apropos of Coley's case which was included in his series of undescended testes, but was operated upon by another surgeon, Coley is inclined to believe that the malignant degeneration was present before the orchidopexy was performed, not being recognized at the time of operation; the malignancy becoming clinically evident one month following operation.

Definite injury frequently precedes the appearance of the various forms of teratoma testis, and, since trauma is an effective method of parthenogenesis, there is good reason to believe that the relation of this injury to the tumor is in this case direct, for these tumors develop from aberrant sex cells. Stockard believes that teratoma in man often occurs as the result of a twin inclusion. Throughout the entire series of embryonal tumors, there is a sound basis for ascribing more than ordinary significance to a history of severe or mild and repeated injury (Ewing).

The importance of the relationship between trauma and malignant disease

from an industrial standpoint has recently been emphasized in an editorial of the *American Medical Association Journal* and referring to tumors of the testicles, the editor states that the round-cell tumor of the testicle which some authors call carcinoma, seems to be the only malignant growth of organs which is definitely produced by a single traumatism. Ophuls believes that such cases are frequent. Grassman collected 20 cases of malignant testes from the Pathologic Institute of Munich. The work of Grassman shows 19 of the tumors occurring in men of the working classes; similarly Miyata found 15 of 27 cases occurring in the working classes. In the case herein reported, the history of trauma bears a definite relation to the appearance and development of the tumor.

Trauma as an active cause in the development of malignancy of the testicle is attested by many case reports and a number of the studies carried out to this end.

Prognosis.—The mortality is very high. Very few recoveries from malignancy of the undescended testis can be found in the literature. Chevassau reports of 100 malignant testicular tumors treated by castration, 81 died and 19 recovered. O'Crowley and Maitland reporting 13 cases of malignant disease of the testicle, 7 died, 3 within one year, 2 within two years and 2 within 3 years. Miyata, quoting Gross, Sidney, Mayer and Bierbaum, states that the expectation of a favorable result following the removal of a primary growth is only 31 per cent. The remaining 69 per cent. of the operated cases were already inoperable or metastasis was present which was overlooked. Legueu reports a series of 100 testicular tumors with 19 cured after three years. In Bulkley's collected cases, excision was done in 37 with a mortality of 10 per cent.; only one of the 37 remained well over two years. Coley states that the duration of life in malignancy of undescended testicle is worthy of especial note, it being much shorter than in the ordinary scrotal type. The clinical course is very variable and may be rapidly fatal. In Blank's collected cases of malignant abdominal tumors, the duration of life after the appearance of the growth was between 13 days and 4 years. In Chevassau's collected cases of abdominal malignant testicles, death occurred from 2 months to one and one-half years following the appearance of the growth. Five of the six cases of Odiorne and Simmons died within one year. Of Kocher's 55 collected cases of malignant undescended testes, there was not one case of cure. Howard was able to trace only three of his nine cases of malignant inguinal testes, two of them died rapidly with recurrence in the lumbar glands, while one was alive and well two years and nine months after the operation.

The prognosis is dependent as in malignancy elsewhere upon an early diagnosis and a prompt radical operation.

Treatment.—As noted above, malignancy of the testes and particularly of the retained testes offers a most gloomy prognosis unless early and prompt surgical treatment is carried out, as the lymph-nodes are early involved.

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There are several procedures open to the surgeon in operable cases. 1. Orchidectomy followed by a thorough course of treatment with the mixed toxins of *Bacillus prodigiosus* and erysipelas as recommended by Coley. 2. The radical operation of removal of the testicle with its primary lymphatic zone as proposed by Chevassau and strongly advocated by Hinman and others. The operation that is usually performed is castration. Malignancy of the testes treated by simple castration is highly fatal with a final mortality of over 85 per cent.

An analysis of Coley's cases treated by castration and toxins shows a certain mortality of over 80 per cent. In 7 of the 12 cases of undescended testes, death occurred within one year from the beginning of the first symptoms, only 3 cases lived over 3 years, and in all of the latter mixed toxins were used after operation. None of the cases, however, have lived long enough to be pronounced cured.

The high mortality following simple castration urgently indicates the necessity of complete surgical extirpation of the testicle with all the lymph-nodes in direct line for metastatic infection. The presence of clinical evidence indicative of lumbar metastases or an epigastric tumor, renders the case unsuitable for the radical operation. The latter is of no avail once the primary lymphatic zone has been passed and secondary metastases are clinically evident.

The careful analysis of Miyata shows but 31 per cent. of the cases suitable for operation, necessitating a careful selection of the cases in which the radical operation is to be carried out.

It should be remembered that enlarged lymph-nodes do not always signify malignant invasion. Changes in lymph-nodes draining malignant tumors show that the implantation of metastases is preceded by a period of preparation of the soil (Ewing). For weeks or months before actual tumor invasion the regional nodes are moderately swollen. During this period many new lymph-nodes may develop in the course of the vessels (Ewing, Küttner). These changes are the result of the absorption of toxic products from the tumor, either autolytic or bacterial. When the metastatic period is established, lymph-node invasion may follow rapidly. In a few cases the tumor cells skip the regional lymphatics and yield distant metastases.

Edwin Beer, in a monograph on tumors of testicle, supports the radical operation and has put the problem thus. Even though at present the mortality of this operation is higher than that of simple castration, experience has shown that such is the case in all new operations. The writer feels that the mortality from this operation will be markedly reduced. Moreover, we are justified in expecting better end results when the gland-bearing area is removed. Operations for malignancy in other parts of the body support this position. The fight against cancer cannot be half-hearted. The surgeon must strike hard or fail in his duty.

Roberts, of Philadelphia, in 1902 performed the operation of complete removal of a malignant testicle with lumbar metastases, but the patient was old and fat and the operation was performed secondary to a recurrence. Gregorie, in 1905, performed the first complete radical operation.

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Hinman's thorough and careful study of this surgical problem and his report of five successful radical operations for teratoma testes without a single troublesome operative or post-operative complication is very encouraging.

Barringer and Dean, in a series of 36 cases of teratoma testes, found but three classified as "primary operable," that is, at time of admission showed by physical examination neither such local extension nor metastatic involvement as would prevent the complete radical removal of the tumor process. The above cases were irradiated before and after operation with the radium pack. Of the three primary operable cases, one is living without recurrence, nine months after first being seen, one is dead and one is lost track of. Hinman, following radical operation without radium, has one patient living after seven years in whom glandular metastases had occurred. Six other patients are all alive over one year. The longest next to seven is four years. In all of the latter cases malignant metastases were found in the gland area removed, except in two. The case of the writer is living one year after the operation; no glandular metastasis was present in the author's case.

The operation in the case herein reported was carried out essentially as described by Hinman (in *Surgery, Gynecology and Obstetrics*, May, 1919, p. 495).

Barringer and Dean say, "That handling the testicle before its vessels and lymphatics are cut tends, we believe, to squeeze tumor cells into the circulation." They, therefore, cut the vas before proceeding with the extraperitoneal dissection of the lymphatic area, the testicle lying in its bed during this dissection, the latter being dissected out and removed as the final stage of the operation and the wound sewed up.

Radium is a very valuable adjunct in the treatment of these cases and seems of particular value in cases where large inoperable masses are present. Barringer and Dean in from three to six weeks after the wound is healed again apply radium packs over the length of the scar.

In the successful removal of glandular metastases, resection of the inferior mesenteric artery may be required. Hinman has tied off many of these arteries in dogs, cats and rabbits with absolutely no effect. Pathologists tell us that it is frequently found completely obstructed without apparent injury to the intestines and other surgeons have tied this vessel next to the aorta without hesitation. Careful studies of the blood supply of the colon, which are now in preparation by the writer, indicate a free anastomosis in this region, frequently the region supplied by the inferior mesenteric artery has additional blood supply from the adjacent vessels. The latter subject will be presented in detail in a later study.

The case reported in this paper was operated upon by the writer in the service of Dr. Chas. F. Nassau at the Mt. Sinai Hospital, and I am indebted to Doctor Nassau for his courtesy in allowing me to publish the case.

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RESULTS OF TREATMENT IN FORTY-EIGHT CASES OF SCIATICA

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In a previous paper I reported the results in thirty-four cases of sciatica treated by removal of foci of infection and epidural injections of saline solution. Since then fourteen other cases have been treated in a similar manner. The results from both series are reported herein.

The cases in which this method of treatment was used represent those in which the sciatic pain was not due to diabetes, syphilis, caudal tumor, or other common causes of so-called sciatica. Slight changes in the bone were found in certain cases, but in none could the changes be definitely shown to be the cause of the sciatica.

The symptoms of sciatica are too well known to need repetition. The cases have not been classified into sciatic neuritis and sciatic neuralgia, for such classification is not always possible. Cases in which the sciatic pain could be definitely attributed to some condition of the bone, or to sacro-iliac or hip-joint disease, and those in which the diagnosis was doubtful, have been eliminated.

TABLE I

SEX, AGE AND DURATION OF SYMPTOMS

Sex	Average age, years	Duration of symptoms
Males, 40	Thirty-nine and one-half	Longest, ten years
Females, 8	Oldest, seventy; youngest, twenty-two	Shortest, three weeks
		Average, eleven and one-half months

SYMPTOMS

	Patients	Per cent.
Definite attacks with free intervals.....	20	
Pain more or less constant since onset.....	28	58.3
Pain over the area of sciatic distribution on one side.....	48	100
Pain over the sacro-iliac region on one side.....	46	96
Pain over the lumbar region on the side affected.....	37	77
Pain over the lumbar region on both sides.....	14	29
Pain over the areas of sciatic distribution on both sides.....	2	4

SEVERITY OF DISEASE

Six patients were bedridden, thirty-two walked by the aid of a crutch or cane, ten patients were able to walk without support.

TREATMENT OF SCIATICA

CAUSATIVE FACTORS

	Patients
Occupation a probable factor.....	3
History of acute infection preceding attack.....	6
Strain or wrench of the back a possible factor.....	11
No predisposing causes.....	28

POSITIVE FINDINGS

	Patients	Per cent.
Lasègue's sign positive	46	96.0
Atrophy, muscles of extremities affected.....	18	37.0
Achilles reflex diminished or absent	24	50.0
Changes in surface temperature of the leg.....	4	8.3
Tenderness over the trunk of the sciatic nerve.....	44	92.0
Limitation of motion of the spine (mild).....	15	31.2
Hypertrophic arthritis of lumbar spine (mild).....	6	12.5
Sacro-iliac disease (?).....	2	4.1
Hypertrophic arthritis of hip (mild)	1	2.0
Hypertrophic arthritis of knee (mild).....	1	2.0
Lesion of the fourth and fifth lumbar vertebræ (character unknown) 1	1	2.0
Old healed fracture of the femur.....	1	2.0
Fusion of sacrum and fifth lumbar vertebra.....	1	2.0

The prominent symptoms and findings are tabulated in the accompanying table. It will be noted that all of the patients complained of pain over the lower area of sciatic distribution, in the sacro-iliac region in ninety-six per cent., in the lumbar region on the side affected in seventy-seven per cent., and on the opposite side in twenty-nine per cent. Bilateral sciatica was present in two cases (four per cent.). Of the objective symptoms, tenderness over the sciatic trunk was present in ninety-two per cent. of the cases, Lasègue's sign was positive in ninety-six per cent., there was atrophy of some of the muscles of the extremity in thirty-seven per cent., and the Achilles reflex was diminished or absent in fifty per cent. On the whole, however, neurologic findings were mainly negative and the diagnosis had to be made largely from the subjective symptoms.

After all cases have been ruled out in which sciatica is caused by some demonstrable condition, such as malignant growth pressing on the lumbosacral plexus, sacro-iliac disease, syphilis, diabetes mellitus, tumor of the pelvis, and so forth, there still remains a large group of cases of sciatica, perhaps the larger group, in which the cause of the sciatic pain must be looked on as the result of an infectious process. The exact seat of the pathologic process is not always* determinable. Dejerine and his followers classify sciatica into two groups: neuritis of the trunk and neuritis of the roots. Others^o attribute rheumatic sciatica to osteo-arthritis of the intervertebral foramina with secondary neuritis of the roots.

Observations were made after the injection of 60 c.c. of a solution of methylene blue into the epidural space of a fresh cadaver. The fluid passed

to the outer edge of the ganglia about 0.5 cm. distal to the site of branching off of the dorsal nerves; in the sacral region, however, it passed slightly farther. The fluid did not reach the subdural or subarachnoid space. The pressure of the injected fluid is exerted either on the roots covered by a fold of dura or on the ganglia in the foramina and slightly beyond (Fig. 1). The fact that ninety-six per cent. of the patients experienced pain over the areas of sciatic distribution on the diseased side and not on the opposite side during the injection, is evidence that either the roots or the ganglia were hypersensitive on the affected side. If the inflammation were distal to the ganglia exclusively, pain from the pressure of the fluid should not be experienced on the affected side more than on the unaffected side, if at all. Incidentally, it was noted that the fluid passed epidurally to the upper cervical region; in fact, there was as much fluid in the cervical region as was present in the lumbar region. These results are somewhat different from those reported by Thompson.

Interstitial fibrosis and thickening of the sheath of the sciatic trunk are described in the literature, but I have been unable to find reports of careful histologic studies of the roots and ganglia in cases of sciatica. As yet information is very incomplete concerning the pathologic changes and the location of lesions in so-called idiopathic sciatica. In view of the fact that in the greater percentage of the cases under consideration, symptoms were caused probably by an infectious process directly affecting the roots, the ganglia, or the trunk of the sciatic nerve, or possibly were due to toxic products from infection elsewhere in the body, causing deleterious changes in some of these structures, it seemed important to remove all possible foci of infection. Of the forty-eight patients whose cases are presented, twenty-two had infected tonsils and fifteen had foci of infection around the teeth.

Various methods for the treatment of sciatica have been tried, all of which are more or less unsatisfactory. In the earlier methods of treatment, various chemicals were injected along the course of the nerve; Schleich, in 1895, used massive infiltration of his anæsthetizing solution along the course of the sciatic trunk. Later, the same method was modified by Bloch. In 1904, Lange used normal saline solution containing eucain, the injection being made into the nerve by inserting the needle into the ischiadic foramen by a technic which he described, using from 100 to 150 c.c. of the solution. Various men have used, and are still using, this method or a modification of it; some report good results, some poor. Treatment by nerve stretching has fallen into disuse. In 1901, Cathelin and Sicard each described the method of epidural injection into the sacral canal, using cocain solution. In sciatic neuralgia these men used cocain in saline solution. Since that time this method has been quite extensively used and some very favorable results have been reported (Strauss and Feuillade). Among others, Rosenheck and Finkelstein, found the results disappointing. Feuillade states that he was able, by repeated injections, to keep many soldiers on duty who would otherwise have been hospitalized.

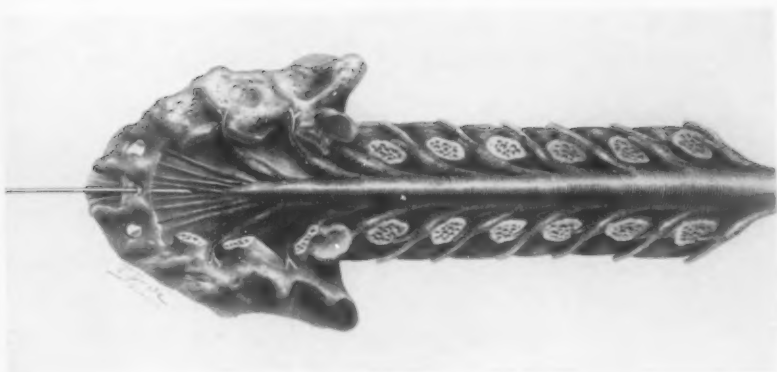


FIG. 1.—Epidural injection.

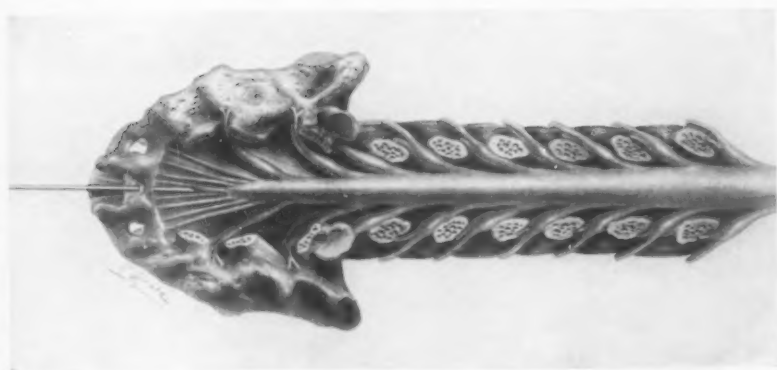


FIG. 2.—Insertion of needle for epidural injection.



TREATMENT OF SCIATICA

The technic of the injection is rather simple and has been described quite fully by Cathelin, Strauss, and others. The armamentarium consists of a 20 c.c. Leur syringe with an ordinary spinal puncture needle. The needle is introduced through the hiatus sacralis into the sacral canal for a distance of from five to six cm. (Fig. 2). Care should be used not to introduce the needle far enough to puncture the dura, the reflection of which takes place in most cases at about the upper margin of the second sacral vertebra. After the introduction of the needle, the trocar should be removed and suction with the syringe made so that the operator may be sure that he has not punctured the subdural space. In case this happens the needle should be withdrawn for from two to three cm. The solution which we use is, ordinarily, five-tenths per cent. novocain in physiologic saline. The fluid is introduced slowly to prevent severe pain; fifty c.c. is sufficient usually for one injection. If relief is not obtained the injections may be repeated every forty-eight hours; sometimes seven or eight injections are required. It has been our experience that in most cases the first injection relieves the pain entirely for two to three hours and ameliorates it for from two to ten days, but that usually one or two more injections are necessary for total relief.

Of the forty-eight patients treated by epidural injections, nineteen had one injection, fourteen had two injections, nine had three, six had four. Fourteen patients were relieved completely and permanently, eighteen were relieved partially, so that they were able to return to work, one was relieved for one month, and fifteen received no permanent benefit. Forty-one of the forty-eight patients obtained temporary relief, that is, relief lasting from two days to two weeks.

These results do not take into consideration that in the larger number of cases, foci of infection were removed either a few days before or a few days after the injection, and that in some instances their removal was probably a factor in the cure (Table II). However, eight patients were permanently cured by injections alone.

TABLE II

RELATION OF ERADICATION OF FOCI TO RESULTS

	Patients
Foci of infection were removed in.....	30
Patients permanently relieved.....	14
Foci of infection removed in.....	6
Foci not removed in.....	8
Patients partially relieved permanently.....	18
Foci removed in.....	14
Foci not removed in.....	4
Patients not relieved permanently.....	15
Foci removed in.....	9
Foci not removed in.....	6
Patients relieved with recurrence.....	1
Foci removed in	1

These results are not so striking as those reported by other writers. Feuillade reports eighty per cent. of cures of primary sciatica resulting from exposure, by epidural injections in cases among soldiers. Bum reports that in so-called radicular sciatica seventy-two per cent. of the patients were cured and seven per cent. improved by epidural injections; that in chronic sciatica of the trunk eighty-three per cent. were cured, and ten per cent. improved, by treatment by Lange's infiltration method.

While our results are not entirely satisfactory, yet we feel that the procedure is indicated and justified in certain selected cases. As yet we do not know the relative merits of the injections and the removal of foci of infection in producing beneficial results.

SUMMARY

In forty-eight cases of sciatica in which no definite causative factor could be found, repeated epidural injections, combined with the removal of possible foci of infection in a large percentage, resulted in permanent cure in twenty-nine per cent., and permanent amelioration of symptoms so that the patient was able to continue his occupation with a fair degree of comfort in thirty-seven per cent.; in the remaining thirty-four per cent. no permanent beneficial results were obtained.

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TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting Held March 6, 1922

The President, DR. JOHN H. JOPSON, in the Chair

MALIGNANCY OF THE UNDESCENDED TESTIS

DR. BENJAMIN LIPSHUTZ read a paper with the above title, for which see page 260.

GASTROSTOMY

DR. THOMAS A. SHALLOW read a paper with the above title.

ACTINOMYCOSIS

DR. PENN G. SKILLERN, JR., presented a man, twenty-eight years of age, who was first seen November 30, 1921, with an inflammatory induration of the floor of the mouth, both sides, bounded by the horseshoe curve of the mandible and pointing in the midline midway between the chin and the hyoid bone. At this spot the abscess was incised, liberating a quantity of foul, creamy pus with the stink of a colon bacillus infection.

At first sight this infection suggested Ludwig's angina, but the tongue was not pushed up or fixed. Skiagrams of the teeth for root abscesses and for salivary calculus were negative. A month later—December 30th—the abscess had cleared up and the wound was healed; there remained, however, a slight induration of the tissues around the incision such as frequently follows incision of an abscess of this type. The patient was discharged, cured of the abscess.

About two months later—on February 20, 1922—the patient reported again with an induration the size of a walnut in the submental region, pointing at the site of the former incision, midway between the chin and hyoid bone. Again the mass was incised, but only a few drops of thin, whitish pus escaped, and the greater part of the indurated area remained. Inspection of two of the three drops of pus showed in each a few granules the size and shape of the head of a pin and grayish-yellow in color. The patient was now questioned relative to having worked around a barn or stable. He stated that in July, 1921, he decided to fix up an old stable for a studio. He therefore spent the first two weeks of that month cleaning manure from the ground floor of a stable that had been used for fifteen years, and washing down its walls. The manure was caked to a depth of from six inches to a foot, and it took him two days to remove it. Toward the end of the next month—August—he broke off the crown of a front tooth and went to the dentist, September 1st. About two months after cleaning the

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stable he noticed that when lifting his chin up to shave he experienced a "drawing" sensation in the submental region. This condition remained stationary for two weeks when the patient "caught cold," whereupon the submental region began to swell until it became very hard, but it did not pain until a week later.

Having obtained in the reconstruction of the history data so suggestive of infection with *Actinomyces bovis*, the reporter sent the few drops of pus to a laboratory. Examination of a granule crushed between slides revealed the presence of a ray-fungus.

The patient was immediately started upon ascending doses of a saturated solution of sodium iodide, and now, after two weeks of this treatment, the swelling has diminished to the size of a pea, and the incision is closed.

With regard to the treatment of actinomycosis, Doctor Skillern said that the potassium iodide does not act on the organism itself, but seems to enable the tissues to overcome the disease. It is useless in small doses. Ochsner recommends the treatment of Bollinger, who taught that if we treat cases of actinomycosis exactly as the disease is treated in cattle, the patients will recover just as regularly. Ninety grains of iodide are given in one-half pint of milk, followed by one pint of hot water, every eight hours, for four days; omit for one week, then repeat until there is no sign of the disease for at least a month. Repeat the course once or twice a month after the patient has apparently completely recovered. Fördel, in 1908, showed at the German Surgical Congress six cases of actinomycosis cured by cacodylate of sodium internally, which he believes preferable to the iodides. Kolmer, in Keen's Surgery, states that if the iodides fail, the surgeon may try an autogenous vaccine, and cites Malcolm's case of two years' duration, in which, iodide being swallowed month after month and pound after pound, two sinuses and a nodule gradually healed under weekly subcutaneous injection of a vaccine containing 4,000,000 to 5,000,000 actinofragments. Collie reports a case of actinomycosis successfully treated by a vaccine, which was prepared by Sir Almroth Wright. In this case, too, the iodide had been given freely, but wholly without effect. He was first given a stock, later an autogenous vaccine, and about seventeen inoculations were required to effect cure.

DR. ROBERT H. IVY said that these cases are rather rare, particularly in this country, and that he was surprised that Doctor Skillern's case had healed so quickly under the potassium iodide treatment; thinks this was because of its superficial nature. The most recent literature on the subject tends to the belief that potassium iodide has been overrated in the past, and inclined to a greater dependence on free drainage, X-rays and radium, and possibly vaccine therapy. A recent paper by Colebrook in the *London Lancet* divides the organisms into four types which have cultural differences, but which give rise to the same clinical picture. Doctor Ivy said that last year he had a case of actinomycosis involving the parotid region which was more resistant to any form of treatment than the case reported by Doctor Skillern.

LUXATION OF FOOT

COMPOUND LUXATION OF ELBOW WITH RUPTURE OF BRACHIAL VESSELS

DR. EDWARD B. HODGE presented a woman aged fifty-five years, who was admitted to the Presbyterian Hospital, January 11, 1921. While standing on a chair, her heel had gone through, and she fell on left arm, tearing it across the bend of the elbow.

On admission to hospital there was found a three-inch tear which ran from the middle of the bend of elbow inward and slightly downward, with condyles of humerus protruding, brachial vessels torn, but not bleeding, brachialis and part of biceps torn and median nerve intact across wound. Debridement of wound with ligation of vessels. Section of muscle removed, sterile on culture. Wound swabbed with Dichloramine-T, capsule and muscles sutured with chromic gut, skin with silkworm gut, and rubber tissue drain down to muscles. Dressed in Jones' position.

There was good recovery with reaction to 101° , slight drainage and no local reaction. Drain removed in forty-eight hours. Slight motion of elbow begun on sixth day. Hand remained warm and of good color, but radial not palpable until thirteenth day. Temperature $100^{\circ}+$ on third day and was never quite normal until just before discharge.

On eleventh day, cramp and pain in right calf with general swelling and tenderness, but no enlargement of saphenous or tenderness in its course. L. 20,000 on twentieth day, leg less swollen and no pain. Elbow healed and quiet and motion from acute flexion to 90° . Temperature, 100° - 102° , now falling.

On the twenty-sixth day severe cramp-like pain in left calf, swelling and moderate tenderness with some fluid in knee-joint, temperature up 1° , pulse soft and rapid. Hæmoglobin, 40 per cent.; red blood-cells, 3,250,000; leucocytes, 46,800. No chest signs. Patient gravely ill for a few days. The œdema extended up on to buttock and loin. Then slow, but steady, improvement up until discharge. Out of bed end of eighth week and walking a while later. Elastic support controlled swelling in legs well.

Three months after accident she is in greatly improved general condition, though still anæmic. Arm shows motion from acute flexion to 160° .

The rarity of the original condition alone would warrant report. In spite of the sterile culture from the muscle and clean wound healing, there was probably present slight infection in the wound. In the presence of old cardiac lesion and anæmia, this was the probable cause of the phlebitis.

BACKWARD LUXATION OF FOOT ON LEG WITH FRACTURE OF FIBULA

DOCTOR HODGE presented a woman, forty years of age, who twisted her left ankle. In trying to recover her balance, something happened to her right ankle and she fell to the sidewalk with the right foot in the street. Probably the heel of the shoe caught on the edge of the

curb putting the foot in strong plantar flexion and her weight in this position caused the injury.

When seen fifteen minutes afterward, backward luxation of the foot on the leg was evident. The outline of the articular surface of the tibia could be seen as well as felt, extending nearly an inch over the posterior projection of the heel.

Under gas, reduction was effected less than an hour after the injury. After flexing the leg on thigh to relax the calf muscles, plantar and dorsal flexion of the foot with extension brought easy reduction.

X-ray showed a fracture of the fibula three inches above the lower end, but no other gross lesion. The patient was treated in her home by the use of a fracture box for a few days until the swelling had subsided. Then a split cast was applied. This was removed daily for massage and active motion. Weight-bearing was not allowed for six full weeks as patient was uncertain on crutches and left ankle had been weak for years. Baking and massage were used after fifth week. By these means, swelling and stiffness were greatly reduced and full motion early obtained without pain. After eight weeks, the patient passed from observation, walking well without support and having full painless ankle motion.

Dislocation at the ankle is quite unusual—extremely so without accompanying fracture. This is the only case in the writer's experience. Reduction may be as difficult as it was easy in this case—incision is not infrequently required and difficulty in reduction increases rapidly with lapse of time.

Points emphasized here are rarity of injury and excellent function resulting from early reduction and early active motion.

BILATERAL CONGENITAL ABSENCE OF PATELLA

DR. JOSEPH M. SPELLISY exhibited a photograph of bilateral congenital absence of patellæ in a patient about seventy-five or eighty years of age who was in the service of Dr. Wm. Barton Hopkins some fifteen years ago. This man also had a varus deformity of both feet and could not walk well, but he could flex and extend his knees to normal extent despite the absence of knee caps. Doctor Spellisy also presented röntgenograms of another instance of congenital absence of both patellæ which he had observed in a little boy in his service at St. Joseph's Hospital. He regretted that the child's residence, at a distance from Philadelphia, made it impossible to present him. The films exhibited showed not only the absence of patellæ, but other congenital abnormalities, distortions of fingers and toes and of both elbows. The latter enjoyed but imperfect extension.

DR. A. P. C. ASHHURST said he had seen many years ago, one case of congenital absence of the patella on Dr. G. G. Davis' service at the Orthopædic Hospital, which was associated with hyperextension of the knee; he had also seen a number of other cases in which it was thought for a long time there was no patella but in which it was found that a patella subsequently developed.

NON-ROTATION OF COLON

NON-ROTATION OF COLON

DR. E. J. KLOPP presented a man, aged twenty-nine years, who, having had no serious illness, was attacked September 28, 1921, at 6 P.M. by colicky pain in the region of the umbilicus, which continued more or less constant, until at the end of two hours it disappeared. He was seen by Doctor DaCosta, who made a diagnosis of appendicitis. He was admitted to the Jefferson Hospital, where the reporter operated upon him. No rigidity, pain radiated downwards and upwards, from umbilicus. Temperature, 98°; pulse, 80; respiration, 24; leucocytes, 15,500. Gridiron incision. Upon careful examination, they failed to find the appendix or the cæcum. Incision was enlarged sufficiently to introduce the hand, and palpate the large intestine, which was to the left of the median line and adherent. They were unable to pull it toward the right side. The small bowel which was found in the right side of the abdomen was rather large. In passing the hand toward the upper right quadrant of the abdomen some abnormality was felt. Because of the fact that some of the pain radiated toward the liver an upper right rectus incision was made, hoping to find the cæcum, but did not find it in this location. They saw the duodenum which was not covered by the colon or the transverse mesocolon. The patient took anæsthesia badly, so that no further exploring was done. The gall-bladder and stomach were negative. Both wounds were closed. Nothing removed. Day following operation temperature was 102°/5; pulse, 120; respiration, 30. Temperature became normal on sixth day. He was discharged from the hospital, October 20, 1921.

Cases of non-descent of the cæcum are not infrequent. The appendix may be adherent to the gall-bladder, stomach or duodenum. Occasionally the appendix is to the left and above the umbilicus. Delatour reported such a case in the *ANNALS OF SURGERY*, January, 1915. The tip of the appendix was adherent to the left kidney. He reported one case of incomplete descent, and one case of non-rotation with the appendix in the left iliac fossa. In the same number of the *ANNALS OF SURGERY*, Downes reported a case of gastric ulcer with non-rotation of the colon. He performed an anterior gastro-enterostomy with an eight-inch loop with good results.

C. H. Mayo, *Med. Rec.*, March 2, 1912, reported in detail five cases of left-sided appendicitis operated upon in St. Mary's Hospital, three for appendicitis, two for acute abscess. One case diagnosed before operation—from physical signs and X-ray. He states that up to that time approximately 300 cases of complete transposition of the abdominal viscera had been reported in literature. He says that non-rotation of the colon should be considered probable when no colon is found on the right side, and positive if the duodenum is movable—it has a mesentery when it merges directly into the jejunum, and when it is uncovered by transverse colon or its mesentery.

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Röntgenologic Report.—Patient was referred to the X-ray service of Jefferson Hospital, with the request to locate the appendix if possible. He was given the usual test meal, and in six hours the barium completely emptied through the ileum and small intestine, unable to locate the cæcum. The patient returned after a few days with the intestinal tract empty of the barium. He was given another barium meal which showed the stomach practically normal, tendency to be over rather to the left and high, with the pylorus patulous, and the duodenum patulous with no tendency to abnormality. Barium meals passed down from the stomach into the small intestine, entering the colon somewhere in the pelvis in the mid-line. A colon injection showed that the barium meal took the course shown on the plate. The previous operation made it difficult for them to palpate, but they determined that the colon was on the left side and the small intestine on the right side. There was complete non-rotation of the colon.

In reviewing the literature it appears that the majority of cases are not a complete but a partial non-rotation of the colon with incomplete descent. Often there is a high cæcum with a retrocæcal appendix.

DOCTOR ASHHURST said that several years ago he saw an operation done for chronic appendicitis in which the appendix could not be found. Subsequently, Doctor Ashhurst operated on the same patient for intestinal obstruction and found non-rotation of the ascending colon. The patient died. In the last volume (volume v) of the Medical and Surgical Reports of the Episcopal Hospital, Doctor Voglein reported a patient of Doctor Deaver's with the same condition who was completely relieved of his obstructive symptoms by a cæco-sigmoidostomy.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

Stated Meeting Held April 12, 1922

The President, DR. JOHN A. HARTWELL, in the Chair

INTRAHEPATIC CHOLELITHIASIS

DR. RICHARD LEWISOHN presented a man, thirty-nine years old, upon whom he had operated seven years ago at Beth Israel Hospital. The patient was suffering from severe pains in the right epigastrium, with fever, chills and marked rigidity (peritoneal irritation). Pre-operative diagnosis: acute cholecystitis or perforated duodenal ulcer. Immediate operation revealed that the patient was suffering from intrahepatic cholelithiasis. The whole surface of the liver was studded with innumerable small tumors which simulated malignancy. Incision of one of these small nodules revealed a few small gall-stones. Upon further exploration it was seen that one of these pseudo-tumors, situated at the under surface of the liver, had ruptured spontaneously, thus giving rise to the acute symptoms.

The gall-bladder contained half a dozen stones, entirely different in size and color from those found in the liver. The gall-bladder was drained and the operative field packed with gauze.

The patient made a good operative recovery. A biliary fistula closed spontaneously after eight months. He was readmitted two years later to the same hospital with recurrence of symptoms and operated by Doctor Goodman. No stones were found in the gall-bladder. A cholecystostomy was performed. Patient had a profuse post-operative hemorrhage (cause unknown) which required a revision of the operative field and several transfusions of blood. He has had several light attacks of gall-stone colic during the last few years.

Doctor Lewisohn stated that this patient represented a unique case, *i.e.*, spontaneous perforation of intrahepatic gall-stones. This case was published in the *ANNALS OF SURGERY*, 1916, vol. lxiii, p. 535. It was certainly remarkable that this patient was in good health to-day without jaundice, though the hepatic ducts with all their branches were filled with stones.

SARCOMA OF RIB

DOCTOR LEWISOHN presented a patient, eighteen years old, who was admitted to Beth Israel Hospital six weeks ago. The patient had noticed a swelling on the left side of the chest for the past five months. The swelling had grown gradually to its present size ($2\frac{1}{2}$ by $3\frac{1}{2}$ inches). The tumor was situated in the axillary line and seemed to originate from the tenth rib. Wassermann and X-ray of the chest were negative.

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Aspiration of the tumor did not yield pus. Pre-operative diagnosis: osteochondroma or sarcoma of rib.

The tumor was explored by an incision along the tenth rib and freed from the surrounding tissues. Both pleura and parietal peritoneum presented themselves. The tumor was carefully freed from these structures. That portion of the tenth rib, which was occupied by the tumor, was then resected and the wound was closed.

Pathological report: Round-cell sarcoma.

The patient receives radium treatment in order to prevent a recurrence. These tumors are supposed to be very malignant.

URINARY FISTULA FOLLOWING URETEROTOMY

DOCTOR LEWISOHN presented a woman, thirty-two years old, upon whom he had operated at Beth Israel Hospital five months ago. She had typical attacks of vesical colic for about a year previous to her admission. The attacks were very severe and occurred every few weeks. X-ray examination showed a small calculus at the vesico-ureteral junction.

Cystoscopy showed a normal right ureteral orifice. The left ureteral orifice presented a large red slit and protruded into the lumen of the bladder. The left ureter was obstructed right above the orifice, the right ureter patulous.

The left ureter was exposed about $2\frac{1}{2}$ inches above its entrance into the bladder. Attempts to milk the stone up failed. The ureter was then incised. The stone could not be dislodged with forceps or any other instrument. It was then decided to expose the stone *in situ*. An incision was made at the uretero-vesical junction. The small stone was so densely impacted in the ureteral mucosa that it could only be removed with the aid of a sharp spoon. Both incisions were closed with catgut sutures.

The incision at the uretero-vesical junction healed primarily. The first incision did not heal, leaving a complete urinary fistula on the left side. Cystoscopy and ureteral catheterization showed what appeared to be a complete obstruction on the left side, about $2\frac{1}{2}$ inches above the orifice. Even very fine bougies could not pass the obstruction. Both kidneys were functioning well (indigocarmine injection).

The patient was very much annoyed by the profuse flow of urine through the fistula, which required constant changing of dressings. A nephrectomy was advised, as a spontaneous cure appeared out of the question after so long an interval, and in view of the cystoscopic findings. However, to the surprise of all who followed the case, the fistula closed spontaneously two and a half months after the operation.

No untoward symptoms followed this spontaneous closure. The patient has been perfectly well during the last year. A recent cystoscopy shows a well-functionating kidney and a slight stricture at the side of the previous urinary fistula.

FRACTURE DISLOCATION OF CERVICAL SPINE

DR. ALFRED S. TAYLOR presented a young man, twenty-nine years of age. Six years ago he had dislocations of his patella and his left shoulder. In spite of treatment at the time, he has always been subject to recurrent dislocations of both the patella and the left shoulder.

FRACTURE DISLOCATION OF CERVICAL SPINE

February 23, 1920, while wrestling, his neck was strongly flexed in a double Nelson hold. Suddenly there was a snap in his neck and he fell to the floor powerless. When he was lifted into bed and placed upon his back, he could move both upper extremities, but with very slight power. The lower extremities showed, as far as he could see, no involvement. There was no disturbance of the sphincters. When he turned the head to either side, or attempted to raise it from the pillow, he had severe pain in the neck. He noticed no disturbance in breathing, except that he could not blow his nose satisfactorily. Movement of the body caused pain in the neck. He also had pain in the right shoulder region.

During the forty-eight hours after the accident, power in the upper extremities gradually diminished until only the fingers could be moved. At that time improvement began, and was steady. He was first seen on February 28, five days after his accident. He was lying on his back in the characteristic attitude associated with an injury at the level of the fifth and sixth vertebræ. The arms were abducted to 90°. The elbows were fully flexed, the forearm partly supinated and the hands lying upon the upper chest. The left arm and forearm could be moved freely with fair power, but the digits had very little power. There was some diminution of sensation on the back of the forearm and hand. On the right side the digits had free motion and considerable power, but the triceps and shoulder cap muscles were distinctly weak. There was also diminished sensation over the postero-external aspect of the forearm and hand. The reflexes were entirely absent in both upper extremities. The abdominal and cremasteric reflexes were absent on both sides. The K-J's were lively on both sides. The A-J's were normal. Babinski was absent on both sides. On the left side there was a very rapidly exhaustible ankle clonus. Ankle clonus was absent on the right side. There seemed to be no loss of power and no ataxia in the lower extremities. Below the level of dorsal ii there was some disturbance in thermal sensation, both hot and cold being called "hot." Either flexion or rotation of the neck to either side caused pain. There was marked tenderness over the lower cervical spinous processes, one of which was unduly prominent. Diagnosis of fracture dislocation of the cervical spine was made. Stereoscopic pictures showed bilateral dislocation forward of cervical v upon cervical vi.

He was taken to the Hospital for the Ruptured and Crippled, on Doctor Gibney's service, where on March 3, nine days after his injury, he was put upon a Hawley table. Suspension apparatus was put about his head and his neck was stretched. After the stretching had continued for a few minutes, steady, gentle hyperextension was used. At the end of five minutes there was a sudden click which the patient felt, and he said his pain was gone. Palpation of the spinous processes showed them to be again in proper alignment. The head could be rotated to either side very much further than before and with absolutely no pain. He also stated that he could move his arms much more freely, and proceeded to demonstrate the fact. This stretching was carried out with the patient on his back and without an anæsthetic. A plaster-of-Paris jacket and

collar were applied right on the table so as to maintain elongation of the neck and definite hyperextension. He was returned to bed in good condition.

A radiograph taken March 6, three days after the manipulation, showed the alignment of the vertebræ to be almost perfect, but the intervertebral space between cervical v and vi was narrower than the others. While his arm movements were more free immediately after the reduction, twenty-four hours later they were back just where they had been before and he had considerable dull, steady pain in the right shoulder region. The pain in his neck was gone and he could rotate his head freely to both sides. After about ten days the plaster jacket and collar had become rather uncomfortable and a reinforced leather collar, with shoulder extensions, was made to replace it. With this harness on he returned home.

On March 23, twenty days after the reduction, further pictures showed considerable recurrence of the deformity. Investigation showed that he had taken off his reinforced leather apparatus for the purpose of shaving, bathing, etc., against instructions. He was taken back to the hospital and an attempt at reduction, similar to the first, was repeated. The reduction seemed nearly as complete as the primary one. Again the plaster jacket was placed on the trunk and neck. A picture taken the day after this second procedure showed almost a complete reduction. He was allowed to remain in the plaster jacket, but at the end of a week it had become so uncomfortable that a new one was put on. It was then thought that a juremast brace, which would take the weight of the head off the neck and maintain hyperextension, would be much more comfortable, and just as efficient as the plaster jacket. Such a brace was made and applied. On June 19 pictures were taken and a recurrence of the deformity was found.

On June 24 he was operated upon under local anæsthesia at the Hospital for the Ruptured and Crippled. A median incision was made from cervical iii to vii inclusive. The spinous processes of cervical v and vi were exposed, also the articular processes between the v and vi. The tissues surrounding the spinous processes and the articular processes maintained the appearance as though they had been damaged only a day or two before, except for the fact that the neighborhood was drier than would be the case in a fresh accident. There was almost no evidence of any reparative process having occurred. The articular processes were not locked; they could be made out clearly and the articular surfaces were just overlapping in the normal relation. Attempts were made, both by manipulating the head, by prying at the bones and finally by using a steel hook under the arch of cervical v to reduce the deformity. The most that could be accomplished was a reduction of about twenty-five per cent. of the deformity. In order to maintain this reduction it was necessary to anchor the spinous processes of cervical v and vi together, and these were so anchored by means of heavy, braided silk sutures, which were passed around them and tied. The spinous processes were still separated by an interval of nearly three cm. The wound was closed,

FRACTURE DISLOCATION OF CERVICAL SPINE

sterile dressing applied, and he was returned to bed. After healing had occurred he was again allowed to be up and about in his brace. During the interval between the first reduction and the final attempt by open operation, there had been a complete disappearance of all of his motor and sensory disturbances, except that he could not bring his right hand up his back more than sixty per cent. of the normal range. He was kept in the brace until March 17, 1921. In other words, for an interval of practically a year. Toward the end of this time pictures taken to check up on conditions showed the beginning of bony union between the fifth and sixth vertebral bodies, in front—also between—the articular processes behind. This was the condition hoped for, as it would give a reasonably solid support against dangerous recurrence of the dislocation.

The interesting features of this case lie in the lack of reparative capacity in the individual. This is apparent not only in the condition of the soft tissues, as seen at the open operation, but is also in evidence because of the recurring dislocations of shoulder and patella. The injury itself must have been chiefly one of direct trauma to the sixth cervical nerves on both sides, with a moderate amount of damage to the cord itself, as indicated by the modification of the reflexes in the lower extremities and the slight sensory disturbances which were noted.

There could have been no serious damage to the cord, or otherwise disturbances of the sphincters and lower extremities would surely have occurred.

The motor losses, as well as the sensory disturbances in the two upper extremities, must have resulted from direct injury to the nerve roots as they left the spine.

If the primary plaster cast had been left on for several months it is more than likely that the recurrent dislocations would not have occurred.

Each time pictures were taken it was evident that the intervertebral disc between cervical v and vi had been seriously damaged and was disappearing. It is probable that the disappearance of this disc, especially in front, and followed by actual bony contact of the anterior lips of the two vertebræ, caused the failure to get a good reduction of the deformity by open operation.

The brace was kept on for a full year before the bony union occurred between the vertebræ because of the failure of his reparative processes and the consequent great risk of a serious recurrent dislocation with damage to the cord.

Right from the start, in spite of the recurrence of the bony deformity, there was steady improvement in the neurological disturbances, and after the first few months there was no evidence of nerve injury except the limitation in certain motions of the right upper extremity. By the end of a year even this had entirely disappeared and he has been and remained perfectly free from any symptoms of disturbance of the nervous system. At the present time he is in perfect physical condition.

He has free mobility of the head and neck without any discomfort. Apparently cervical v and vi are grown together sufficiently so they move as a unit.

DR. ROYAL WHITMAN considered these accidents not uncommon. In most instances the displacement was not sufficient to cause paralysis, the symptoms being stiffness and a disturbance of the torticollis type.

DR. JOHN DOUGLAS recalled a case that had come under his care in St. Luke's Hospital for fractured cervical vertebra about two years ago, a boy who fell with a weight dropping on him. When he was brought to the hospital the only signs were a stiffness of the neck and partial paresis of the left arm. X-ray showed fracture of the fifth cervical vertebra with dislocation of the fourth. A halter was made with two weights of seven or eight pounds, each swinging over the head of the bed on pulleys and extending the patient's neck. This was kept on for eight weeks and he was then put in a plaster cast, which was kept on for three months. One interesting thing about this young man was that he was a compensation case. Within the last two months Doctor Douglas was asked to examine him again, as he was still claiming disability. The X-ray showed a narrowing of the intervertebral disc and a narrowing due to compression of the anterior part of the body of the fractured vertebra. But there was no sensory or motor symptom or change in the knee jerks, or any other reflexes of the legs, arms or trunk. He complained of a subjective symptom: after leaning forward, when writing, for example, he grew dizzy. But as the physical examination showed nothing whatever abnormal, it was very difficult to report or determine how much permanent injury or disability this patient really suffered from.

DR. NATHAN W. GREEN spoke of a patient of his who had suffered a fracture dislocation between the fifth and sixth cervical vertebræ, as shown by X-ray examination. He was not brought to the hospital; he walked in, but with some stiffness of the neck and some paræsthesia of the internal surfaces of his forearms. He had a similar apparatus applied as in Doctor Douglas's case, but with twenty-six pounds traction on his head, the head of the bed was elevated and, after a stiff dose of morphine, this was left on all night with a pretty good reduction. Dr. P. W. Nathan, who was associated with the speaker in this case, brought in his mechanic and made a fine jury mast for the patient and looked after him after discharge from the hospital, with very good results. It is two years now since the accident and the man is apparently perfectly well.

DR. JOHN A. HARTWELL agreed with Doctor Whitman that these cases are not uncommon. They are seen quite frequently at Bellevue and have the typical deformity shown by Doctor Taylor's patient. The interesting fact about this patient is that he had no disturbance of motor activity of the arm during the first five days, and it only developed when he was up and about. This shows that the treatment of rest in bed is most essential because the erect position is always liable to produce additional disturbance.

OSTEOMYELITIS OF THE FEMUR

DOCTOR TAYLOR, in closing the discussion, said that the impression that the patient had no motor symptoms in his arms until he was up and about was wrong. There was partial disturbance in both arms which increased up to forty-eight hours and then decreased until after a few weeks there was recovery. Doctor Taylor had considered that the case might be interesting as showing that a man's neck might be broken merely by wrestling. He agreed with Doctor Whitman and Doctor Hartwell that these cases are not uncommon and that they recover frequently. One reason there was so much difficulty in keeping the dislocation reduced in this particular case was the lack of reparative power evidenced by recurrent dislocations of patellæ and shoulder and by findings during operation; another reason was that the patient was erratic and uncontrollable at times. It seemed to the speaker that the thing that ought to be discussed was how long treatment should continue in cases of this kind. Ordinarily they are looked after for a few weeks. It is difficult to find a statement, with reasons, as to how long treatment should continue and what should be the criterion as to when treatment should cease. This patient had to be treated for a longer time, on account of lack of reparative power constitutionally, than would the ordinary case. Osgood said that in these cases the neck should be kept in an apparatus for one year, because he found in cases not so treated there would sometimes develop a thickening of the bone that would cause pressure on the cord. Doctor Taylor had seen cases where increasing deformity of the bone had caused progressive pressure myelitis of the cord which practically incapacitated the patient. He thought one ought to get good reduction at once and keep it by fixation.

OSTEOMYELITIS OF THE FEMUR

DR. JOHN A. HARTWELL presented a young woman, eighteen years of age, with a request for suggestions as to treatment. The physical examination of the patient gives negative findings except for the right knee and thigh. The knees are asymmetrical, the right having a rounded appearance and the lower thigh musculature looking atrophic. Measurement shows the following:

	Right	Left
Infrapatellar	30 cm.	28 cm.
Suprapatellar	32 cm.	30.5 cm.
Three inches above patella	35 cm.	32.5 cm.
Seven inches above patella	40.5 cm.	39.5 cm.

Motion at admission was limited at the knee only, flexion being stopped at 50 degrees by pain. This has since in part cleared up, following rest in bed without other treatment. She cannot walk, as she cannot bear the weight of her body on the affected leg. There is slight tenderness over a very limited area in the medial epicondyle and just above the adductor tubercle. The lower femur feels definitely enlarged and irregular in outline. There is slight intra-articular effusion. The girl is healthy looking and has gained weight since being in the hospital.

The temperature has averaged 99°. On one day it went up to 103.8° without explanation other than the local condition. The pulse has averaged 100.

X-ray: Sinuses, teeth, cranium, lungs and long bones other than the femur, negative. There is shown no focus of infection. The right femur (Figs. 1 and 2) shows involvement of the entire diaphysis and lower epiphysis, marked by periosteal and endosteal bone production, destruction, involucra, sequestra, and cloaca. Contiguous joints are negative, except as stated above.

Blood: Two cultures have been negative. White blood-cell count, 11,000 to 19,000; red blood-cell count, 4,800,000 to 5,200,000; polymorphonuclears, 67 to 77 per cent.; hæmoglobin, 70 to 80 per cent.; sugar, 100 mgm.-100 c.c. Urine: always negative. Wassermann negative, and negative on four tests two days apart following provocative dose of salvarsan. Von Pirquet indeterminate.

The family history shows a probable tuberculous knee-joint in the father and a brother has tuberculous nodes in neck. The tentative diagnosis lies between tuberculosis and staphylococcus aureus osteomyelitis of low virulence.

DR. ROYAL WHITMAN thought the case one of osteomyelitis, the original focus being in the lower extremity of the femur, as indicated by the local sensitiveness and synovitis. The diffuse changes in the shaft he considered secondary and not unusual in cases of this character. He advised immediate operation to relieve tension and to remove the products of disease.

DR. WILLY MEYER believed that, inasmuch as thickening of the diaphysis is found in specific disease, and of the epiphysial region in tuberculosis, he would tentatively suggest this might be a case of early tuberculosis in the presence of hereditary syphilis.

DR. JAMES M. HITZROT agreed with Doctor Whitman that the patient should be operated upon. He regarded it as a low grade staphylococcic process beginning in the lower part of the femur, in the diaphysis. The periosteal proliferation he regarded as a result of the process in the lower end of the femur. He thought the lower end of the femur should be opened and the bone explored as far as it was diseased.

MASSIVE HYPERTROPHY OF BREASTS

DR. PARKER SYMS showed a young woman, age twenty-one, admitted to Lebanon Hospital November 28, 1921. Family history negative. The patient states that she was perfectly well until two months ago, when she noticed a small lump in her right breast. This did not cause pain, and she does not think it continued to grow after she discovered it. The patient was a normal, healthy individual. Menstruated at eleven, regularly since. She states that her breasts began to enlarge soon after she began to menstruate.

Examination showed a bilateral enlargement of the breasts. In the



FIG. 1.—Showing involvement of entire shaft. Note areas of destruction and of overgrowth with probable sequestra scattered throughout.

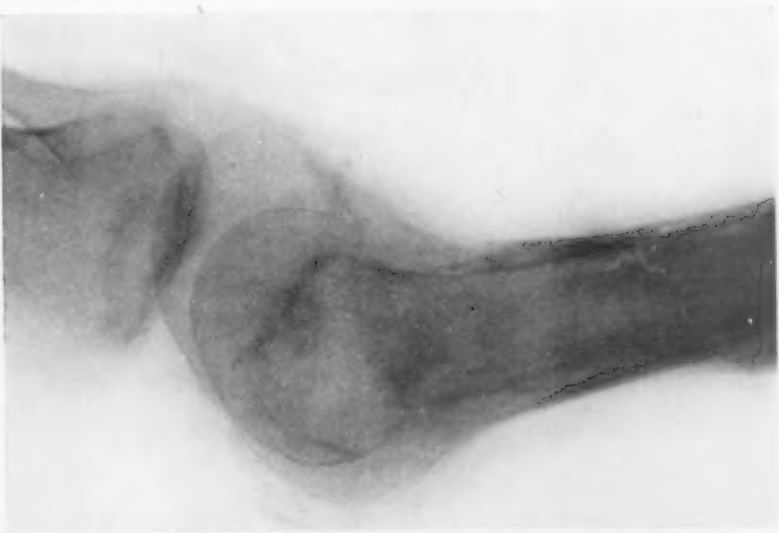


FIG. 2.—Showing process in lower end of femur particularly involving the medial epicondyle. Note the periosteal overgrowth in shaft.



FIG. 3.—Massive hypertrophy of breasts, showing site of tumor (sarcomatous?) which was removed.

MASSIVE HYPERTROPHY OF BREASTS

inner upper quadrant of her right breast was an apparent fibro-epithelial tumor about one and a half inches at its longest axis (Fig. 3). It was for this condition that she entered the hospital, seeking to have it removed. On December 2, under local anæsthesia, this tumor was removed. It was not a distinct encapsulated tumor like a true fibroma or fibro-adenoma; it was like one of the pseudo-tumors that are found in cases of chronic cystic mastitis. He had, elsewhere, called attention to the fact that those are not tumors, but are simply a part of a general process. Like one of those pseudo-tumors, this could not be removed by enucleation or blunt dissection; it had to be cut across, showing that it was not a distinct or separate encapsulated tumor, but was a part of a general process in the breast.

Pathological Report.—Section cuts densely, seems to be made up of fibrous tissue.

Microscopically, shows numerous irregular swirls of spindle cells with fairly deep-stained nuclei. Some areas show many multinuclear giant cells, also considerable connective tissue present. There is also an increased amount of nuclear pigment present.

Diagnosis.—Fibro-sarcoma; spindle-celled type.

Notwithstanding the pathologist's report, he felt from the clinical point of view this could not be regarded as a sarcoma; so the patient has been kept under observation, and is presented to you to-night.

The breasts are evidently the seat of the same abnormal process; at any rate, the entire right breast was evidently the seat of the same process as the tumor-like mass which was removed; if that were clinically sarcoma, the rest of the breast should be also. Since the operation, there has been no growth, such as one would expect from a partial removal of a sarcoma. The breast and the region involved are about in the same condition as they were in, and he felt that they had been justified, in this case, in ignoring the microscopic findings. In rare instances these breasts undergo retrogression, but usually amputation is called for, the patient suffering from the weight and deformity and finally seeking relief.

Excessively enlarged breasts, within physiological limits, of course, are frequently met with. These cannot be considered pathologic, but occasionally breasts grow in size beyond the bounds of physiological development. These become a distinct entity, and may be considered under the term of massive hypertrophy of the breast. The most recent article on this subject was written by Linwood D. Keyser, of the Mayo Clinic. He briefly reviewed the literature and made a detailed report of four cases which had been recorded in the Mayo Clinic. According to him, race and climate have no bearing on etiology. Heredity has been mentioned as a possible factor in three instances. In 182 cases where the side affected was mentioned, 142 were bilateral and forty were unilateral. The duration of the process is extremely variable. Zurakow reported a case of a woman twenty-two years of age, whose breasts became hypertrophied, to a large extent, in the space of two and one-half months. The shortest period of growth in a patient under twenty-one was two

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months, while the longest period was four years; while in women over twenty-one, the shortest period two and one-half months and the longest sixteen years.

Durston, who perhaps published the first authentic case of this disease in 1669, reported that the left breast weighed sixty-four pounds and the right one forty pounds. It was claimed that the entire process of hypertrophy took place within the space of one night. Porter records a case of the left breast weighing forty-three pounds and the right one seventeen pounds. Keyser states that probably the majority of breasts weigh in the neighborhood of ten pounds. In his recent article on this subject he gives the following summary:

1. "Massive hypertrophy of the breast is of two types: (a) fibroepithelial, and (b) adipose.
2. "It may occur between the ages of twelve and forty-eight, but is most frequently associated with puberty or pregnancy.
3. "The normal development of the breast seems to depend on the ovary, and there is evidence which strongly suggests that the massive hypertrophy may be etiologically related to an ovarian malfunction.
4. "If spontaneous regression of the process fails to occur, surgical amputation is, at present, the preferred treatment."

According to Keyser, Labarraque, in 1875, was the first to consider the subject of this matter in a scientific manner.

EXTIRPATION OF THE CERVICAL LYMPH-NODES, RELATED TO CANCER OF THE LIP

DR. GEORGE H. SEMKEN read a paper with the above title.

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